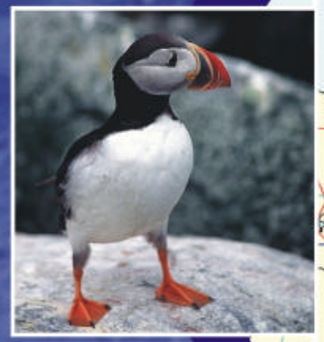
Atlas of Ecologically & Commercially Important Areas in the Southern Gulf of St. Lawrence



Environmental Studies Research Fund

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Introduction

In June 1999, the Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) issued 19 exploration licenses; one of which was for 250,000 ha in the southern Gulf of St. Lawrence off western Cape Breton. An initial strategic environmental assessment identified several important fishery areas; however, a greater level of effort is required to support a more thorough evaluation of environmental features in the southern Gulf.

The Environmental Studies Research Fund (ESRF) supported this compilation of ecologically and commercially important areas in the southern Gulf of St. Lawrence, south of 47°N. The study area includes the north shore of mainland Nova Scotia, the western shore of Cape Breton, and the southeastern shore of New Brunswick.

The ESRF was established under the Canada Petroleum Resources Act "to finance environmental and social studies pertaining to the manner in which, and the terms and conditions under which, exploration, development and production activities on frontier lands under this act or any Act of parliament, should be conducted."

This atlas provides the C-NSOPB, the National Energy Board and to a lesser degree the Canada-Newfoundland Offshore Petroleum Board with useful baseline information for the environmental assessment of subsequent project proposals relative to sensitive areas and critical periods of fisheries resources in the southern Gulf of St. Lawrence.

The majority of the information complied for this atlas is available in digital format acquired from government agencies. The maps illustrate the known distribution of selected ecosystem components and known harvesting areas. The atlas is organized to present information on the resource and accompanied by distribution maps. The first section is a description of the environmental setting of the southern Gulf of St. Lawrence, which provides a broad overview of the study area. The resources described in this atlas include commercially important demersal, pelagic, and shellfish species and other minor species, as well as aquaculture leases. Other ecologically important resources include seals, whales, raptors, shorebirds and coastal waterfowl. Tourism, recreational parks and protected areas are also identified. The atlas is summarized with a section on seasonality and sensitive timing of the resources.

Acknowledgements

The Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) was the scientific authority for this project and was assisted by an Advisory Team. Members of the Advisory Team included representatives from the Nova Scotia Department of Fisheries and Aquaculture, Fisheries and Oceans Canada (Gulf Fisheries Centre), Area 18 Snow Crab Association, Corridor Resources, Canadian Association of Petroleum Producers, Nova Scotia Petroleum Directorate, Tourism Association of Nova Scotia, University of Moncton, National Energy Board and Environment Canada.

Numerous government agencies graciously contributed their digital database information and are largely responsible for the successful compilation of the atlas. Jacques Whitford Environment Limited acknowledges the digital database contributions by John Legault, DFO – Gulf Fisheries Centre Moncton; Marc Lanteigne, DFO - Gulf Fisheries Centre; Elmer Wade, DFO – Dartmouth; Doug Swain, DFO – Gulf Fisheries Centre, Christine Bonnell-Eisnor, C-NSOPB; Sherrie Fahie, DFO - Small Crafts Harbours; David Hopper, NSDNR; Brian Fisher, NSDNR; Richard Hinton, NSDAF and Stephen Gerriets, Atlantic Canada Conservation Data Centre. Archaeological and historical information was researched and provided by Sue Blair and Paula French courtesy of New Brunswick and Nova Scotia provincial records. Chris Milley of the Acadia band office, Joe Johnson and Tom Johnson of Eskasoni Fish and Wildlife Commission provided information on native traditional ecological knowledge studies. Supplementary information on whale species in the study area was provided by Tonya Wimmer and Andrea Ottensmeyer of Dalhousie University.

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

Small Craft Harbour

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Study Area
Southern Gulf of St. Lawrence

Data Source: Department of Fisheries and Oceans, Small Craft Harbours Branch, Maritimes Region

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Environmental Setting of the Southern Gulf of St. Lawrence

Shoreline Boundaries and Bathymetry

The study area is the southern boundary of the Gulf of St. Lawrence, bounded by the shores of western Cape Breton, southeastern New Brunswick and northern Nova Scotia. Prince Edward Island occupies the center of the area. The Gulf of St. Lawrence is considered a semi-enclosed sea and acts in some ways as an extended estuary. It receives significant inflows of fresh water from the St. Lawrence River drainage basin and salt-water flows into the Gulf through the Cabot Strait and Strait of Belle Isle.

There is a variety of coastal environments including low rocky shores, deltas, coastal bluffs, cliffs, coastal dunes, barrier beaches, salt marshes, lagoons, estuaries and tidal flats within this study area. Much of the coastline is of low relief. Wide sandy, pocket sand and gravel beaches are plentiful. Beach erosion by wind, waves and currents is prevalent and the resulting loose material has created barrier beaches, barrier islands, spits, coastal dunes, tombolos (sand or gravel bar connecting an island with the mainland or another island), cuestas (hill or ridge with a steep face on one side and a gentle slope on the other), sea caves, arches and stacks.

Shoreline morphology affects bathymetry. As a general rule, the bolder the coast, the steeper the beach and narrower the seaweed zone below the low water mark (Dunbar et al. 1980). The 60 m contour encloses the southern Gulf of St. Lawrence study area reflecting the low profiles of the coastlines of New Brunswick, Nova Scotia and PEI. The Northumberland Strait is a prominent shallow hydrographic feature between PEI and the mainland with a maximum water depth of 30 m. The high cliffs of western Cape Breton continue down into the marine environment of the Cape Breton Trough, which reaches depths of 150 m.

Water Masses and Circulation

The water of the southern Gulf of St. Lawrence is stratified into a two-layer system in summer which undergo seasonal variations and becomes a one layered system aided by wind mixing during the fall and winter months. During summer, the warm (20º C) surface (1-30 m) layer is flowing out from the Estuary into the Gulf and out through the Cabot Strait. A deeper intermediate (80-150 m) cold (-1º to 2º C) layer flows into the Gulf from the Cabot Strait.

Dominant Horizontal Surface Circulation in the Gulf of St. Lawrence

There are large, seasonally variable runoffs of freshwater into the Gulf, mainly from the St. Lawrence River and rivers of the northern shore. The rate of freshwater flow varies over the year with the maximum occurring during the spring runoff. The spring melt of sea ice is also a significant contributor to the fresh water input. The seasonal influx of fresh water in the St. Lawrence estuary is the driving force for a current that extends through the Gulf. Within the study area, the horizontal surface circulation occurs eastward. Much of the Gulf outflow occurs around the Cape Breton Island side of the Cabot Strait. The inflow of saltier water is greatest along Newfoundland's coast on the eastern side of the Strait.

The overall circulation is counterclockwise in the Gulf. Over the Magdelan Shallows, the currents weaken between the Laurentian Channel and Prince Edward Island before leaving through the Cabot Strait. A small clockwise gyre occurs in St. Georges Bay, Nova Scotia, which provides an important mechanism for entrainment of fish eggs, larvae and pollutants.

Tidal action is the main driving force behind the currents found within Northumberland Strait. Abegweit Passage is the narrowest part of the Strait and has accelerated tidal currents, strong long-shore currents related to wave refraction, and a high frequency of ice jamming in winter. Residual tidal flow is generally west to east (Lauzier 1965), however; the tidal influence is the dominant feature behind the currents. Tidal current velocities have been recorded at 0.5 to 1.0 m/s. Currents affected by wind action can reach velocities of up to 1.2 m/s. By contrast; tidal currents are about 0.2 m/s in most of the Gulf.

Winds

Wind speed and direction are important due to their role in surface current and wave generation. From autumn through the winter and spring many cyclonic disturbances pass through or near the Gulf. These storms can produce gale force winds that may persist for many hours and in some cases for several days. During the summer months when the tracks of cyclonic activity are displaced farther north; the strong winds are less frequent.

Calms are most frequent during August. The wind conditions tend to increase in severity month by month progressively over the next four months. Severity of winds is greatest in December with maximum speeds of up to 85 kts. Wind data from the Central Gulf Area shows the predominant wind direction for highest wind speeds vary from south (August) to northwest (September through December).

Waves

Wave data are limited from January through April due to the presence of sea ice. The wave data were estimated visually from ships or recorded by direct measurement from moored buoys.

Wave conditions in December are more severe than those found from August through to November. Mean wave height increases from 0.9 m (August) to 1.4 m (November) and reaches 1.8 m in December. A maximum significant wave height of 6.0 m was recorded in November.

A recent study used statistical analysis on the Ocean Data Gathering Program (Transportation Development Centre, 1991) hindcast wave data to derive monthly wave heights for the Central Gulf. Calm seas were found to be most common during August. This study found that the predominant wave direction varies from west (August through October) to northwest (November and December).

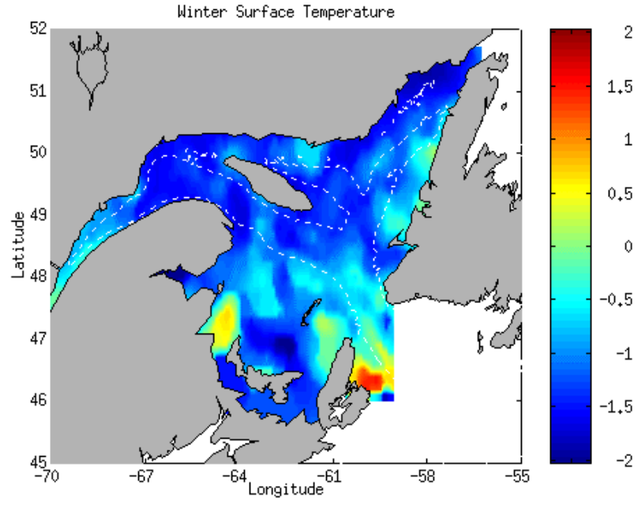
Tides

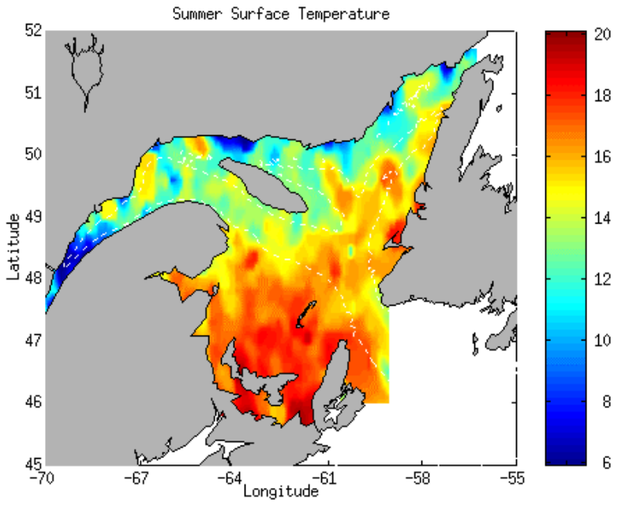
Semidiurnal and diurnal tides from the North Atlantic Ocean enter Cabot Strait and Strait the Belle Isle and propagate counterclockwise around the Gulf of St. Lawrence. Tidal range throughout the Gulf is less than 2.4 m. Semidiurnal tidal amplitude is about 0.3 m along the north coast of Prince Edward Island. In Cabot Strait and in the north and east parts of the Gulf, the range is 0.9 m. Within Northumberland Strait, tidal amplitude normally ranges from 0.5 to 1.2 m, but can reach significantly higher levels during extreme meteorological events such as the passage of storms. In addition pronounced decreases in water level may be associated with offshore winds and high-pressure systems.

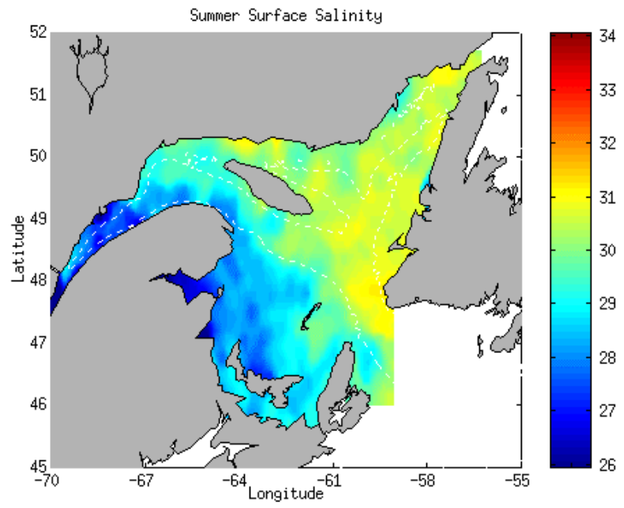
The Canadian Hydrographic Service normally measures currents only in narrow or shallow channels, harbour entrances, congested shipping lanes or berthing areas. Throughout the open areas of the Gulf, tidal currents seldom exceed 1 km/hr, except in the St. Lawrence Estuary, Cabot Strait, Northumberland Strait, Strait of Belle Isle and other locally confined regions.

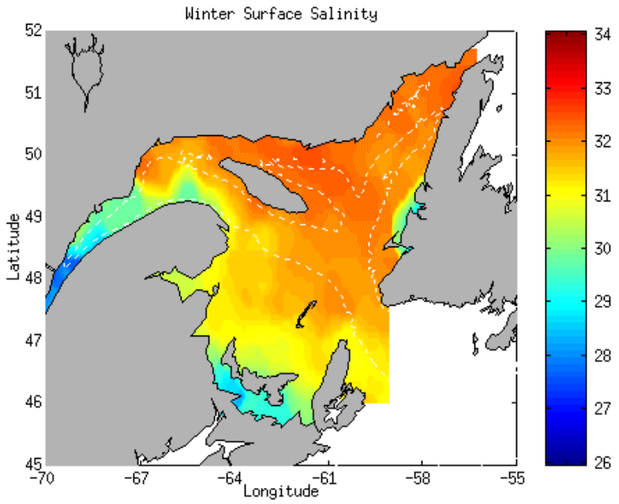
Sea Temperature and Salinity

Sea surface temperature is influenced by ice conditions (Dunbar et al 1980). The Magdalen Shallows and Strait of Belle Isle remain ice-covered into May. The surface waters of the Gulf warms in early spring (May-June) along the west coast of Newfoundland, due in part to oceanic water entering through the Cabot Strait. Solar radiation is the major source of heat during the spring and summer, while evaporation and conduction account for autumn and winter heat losses (Koutitonsky and Bugden 1991). The warm surface layer (10-20 m thick) is usually composed of low salinity water (26‰ to 32‰), the influence of freshwater discharge from the St. Lawrence River. During summer the mean surface temperature is 14-16ºC and mean salinity is 30-31‰ with localized warming in the Northumberland Strait, Magdalen Shallows and west coast of Newfoundland.





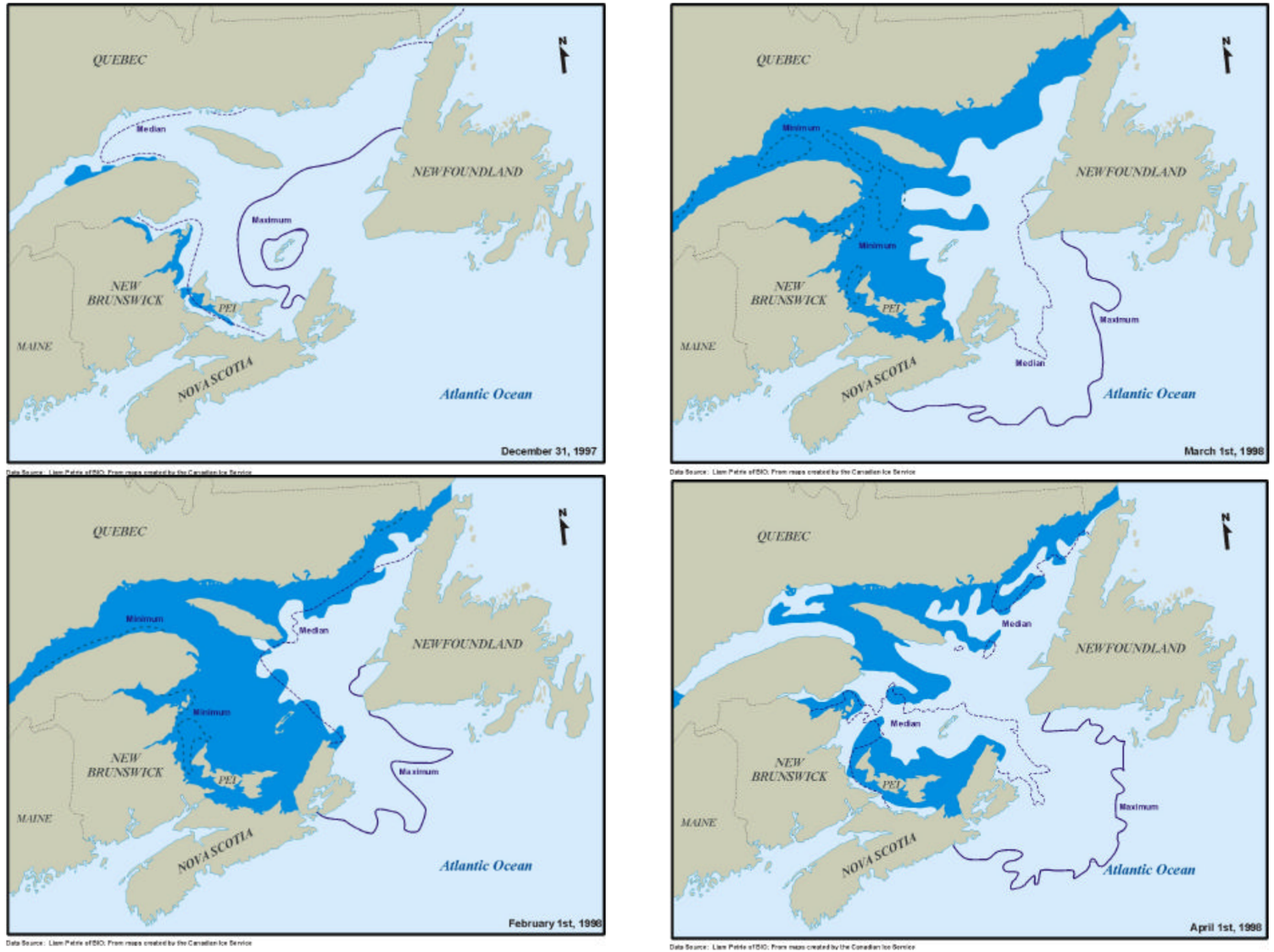




Ice

Floating ice is present in two forms in the marine environment: sea ice and icebergs. Sea ice in the Gulf is mainly of local origin. It begins to form in December and may persist until May. Small amounts of older and thicker Labrador sea ice can enter Strait of Belle Isle usually in late winter. In a normal winter, ice covers the southwest half of the Gulf from Gaspe Peninsula to Cape Breton by early February, with some ice drifting into western Cabot Strait. In mild winters, ice growth may only partially fill the southwest Gulf, with no efflux of ice through the Cabot Strait at any time. In cold years the ice may effectively fill the area by the end of January and drift out of the Gulf through Cabot Strait. Although sea ice extends from the Gulf through Cabot Strait from early February into May, it does not seriously affect shipping in Cabot Strait outside mid-February – mid-April.

Icebergs regularly enter Strait of Belle Isle from the Labrador Sea in April and May. However, due to the limiting depth of 55 m, they are relatively small and few are carried into the main area of the Gulf. "Bergy bits" and growlers may extend into the eastern Gulf before melting.



Seasonal Extent of Sea Ice

Marine Ecosystems

The Gulf of St. Lawrence is characterized as a coastal marine ecosystem due to the predominating effects of the rivers, however, deeper areas have more in common with the Scotian Shelf and Slope and many common species move seasonally between the Gulf and the open Atlantic Ocean. The physical environment and the availability of nutrients affect the relative abundance of marine biota. In general, shallow marine coastal waters have relatively high nutrient availability that results in high productivity. Nutrients are derived from a number of sources including recycling through biological and physical processes, dissolved minerals, municipal waste discharge, and runoff from agricultural lands. Contaminants are also delivered to the ocean in like manner and may affect the distribution of different species or their suitability for commercial exploitation.

Features such as gyres, and upwellings, and currents induce nutrient cycling and distribution throughout the water column. Primary production in the Gulf area is at a maximum in spring (mid-April) and early summer (mid-June), declining as nutrients are exhausted in mid to late summer and increasing temporarily in fall. Productivity is minimal during winter. Results from annual primary production estimates are comparable to coastal Atlantic water and are approximately three to four times greater than the open Atlantic. The main contributors to primary production are phytoplankton, seaweeds, and saltmarshes.

Many species are restricted to areas of the Gulf where their habitat requirements are met. Lobster for an example are found in relatively shallow coastal areas where there are rocky reefs and outcrops, boulders and coarse glacial till that provide opportunity for burrowing. Other species have different and unique requirements that are described in this document.

Offshore Oil and Gas Exploration Licences and Permits

The majority of oil and gas exploration licences and permits within the study area are located onshore.

New Brunswick

Within the New Brunswick portion of the study area, licences from Consolidated Beacon Resources and Corridor Resources Inc. have coastal boundaries and do not encroach seaward of the high tide mark.

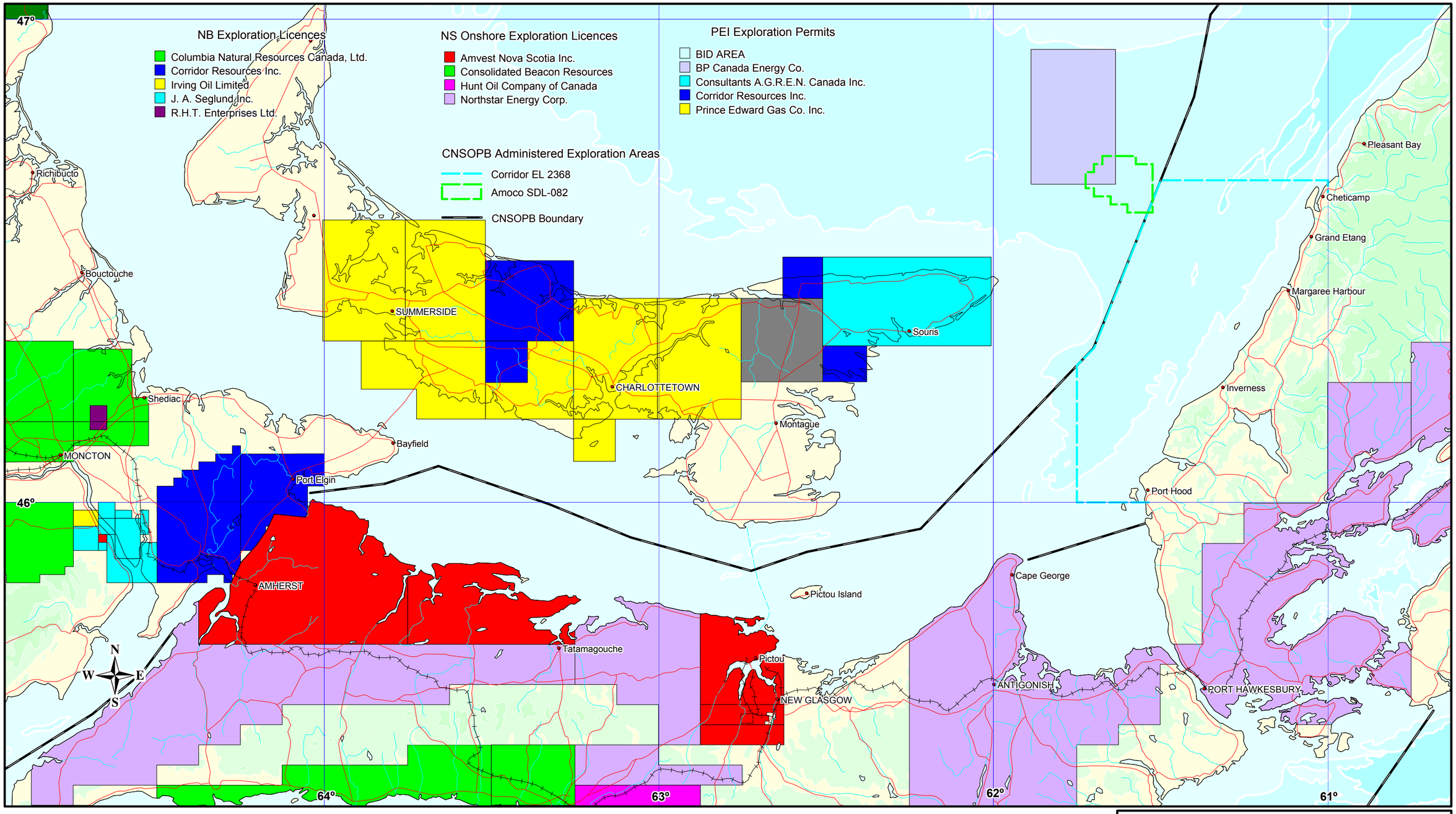
Prince Edward Island

On Prince Edward Island, all petroleum permits are onshore, however, several boundaries extend into the surrounding marine waters including several bays, lagoons, beaches and dunes. There are 11 exploration permits on PEI. Six of the permit blocks are held by Prince Edward Island Gas Co. Inc. and account for the majority of lease areas. Corridor Resources Inc. has three permit blocks and Consultants A.G.R.E.N. Canada Inc. has one permit. A single block is available for future bidding.

Northstar Energy Corp. has an exploration licence in marine waters northeast of Prince Edward Island. This area is outside the jurisdiction of the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) and is the responsibility of the National Energy Board.

Nova Scotia

Much of Nova Scotia's north shore has been licenced for onshore petroleum exploration with the exception of the Merigomish area. Amvest Nova Scotia Inc. and Northstar Energy Corp. are the two companies with coastal licences. There are no onshore coastal lease areas on western Cape Breton Island; however Corridor Resources Inc. and Amoco Canada Petroleum Co. Ltd. have licences in marine waters. Boundaries of the Amoco and Northstar licences overlap about 40 km west of Cheticamp.



Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

0 50 100

Kilometres

Jacques Whitford Environment Limited

Oil & Gas Exploration Licences / Permits

Data Source: CNSOPB; Government of PEI; Government of New Brunswick; Government of Nova Scotia

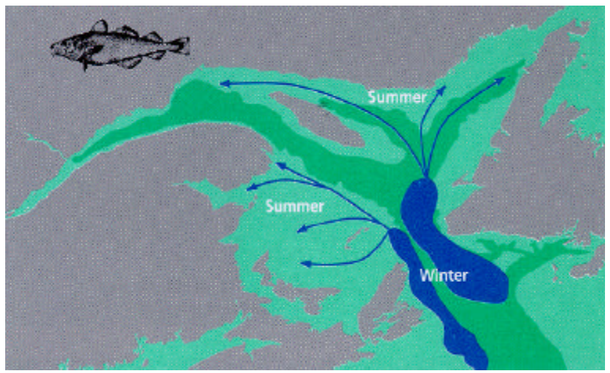
Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Cod (*Gadus morhua*)

Information on this species is derived from DFO stock status report A4-02 (DFO 2000) and Scott and Scott (1988).

Distribution and Biology

The Gulf cod stock is highly migratory. Throughout summer the fish are dispersed over the Magdalen Shallows and Northumberland Strait. The fall migration begins in late October and cod become concentrated off western Cape Breton in November and move into the Sydney Bight (NAFO area 4Vn). The stock overwinters in NAFO area 4Vn and northern 4Vs in deep water along the edge of the Laurentian Channel. The return migration begins in mid-April, although in some years (e.g. 1991-92), this was delayed by the late breakup of the winter ice.



Spring migration routes and winter distribution of Atlantic cod in the Gulf (from White and Johns 1997)

Spawning occurs in the Shediac Valley (northeastern shore of New Brunswick) and around the Magdelan Islands from late April to early July, outside of the study area. Fertilization is external. The eggs are buoyant, remaining near surface during incubation which may take 14 to 60 days depending on water temperature (6º C to 0º C respectively). The young larvae are pelagic until they reach 25-50 mm long when they descend to the bottom. There are no data on larval distribution within the Gulf of St. Lawrence (R. Leblanc, pers. comm.).

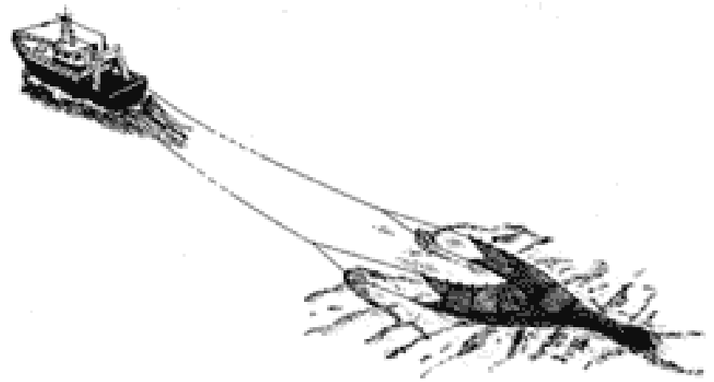
During the summer, the cod are widely distributed while they feed heavily on krill, shrimp, small fish, primarily herring, American plaice, and capelin. Spawning stock biomass has remained stable in recent years.

The productivity of the stock has been low recently because of low recruitment, poor growth and high natural mortality. The situation appears to be improving marginally in terms of growth and incoming year classes seem to be more abundant.

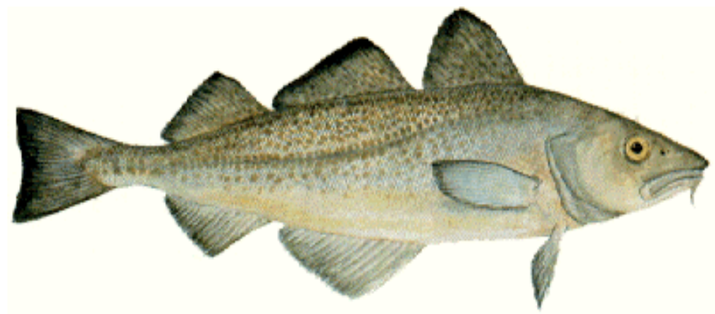
The Fishery

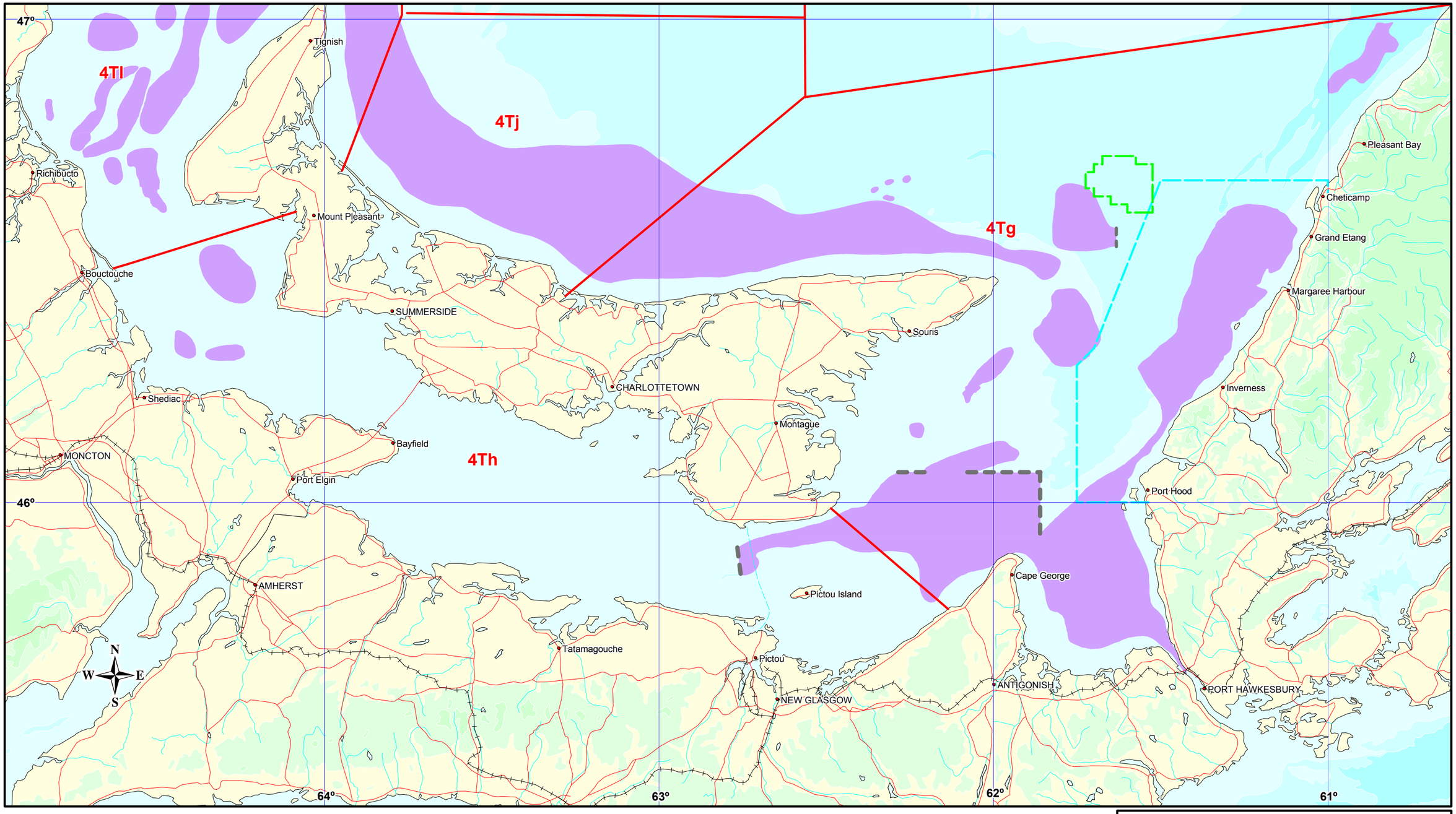
The management unit for this stock includes all of 4T and catches made in 4Vn during winter (November-April). In some years, catches in 4Vs in January-April are attributed to this stock. In recent years, the winter fishery in 4Vsb has been closed to avoid catching southern Gulf cod. The stock has been exploited since at least the 16th century primarily with hook and line until the late 1940s, when a ban on otter trawling was lifted. Management by total allowable catches (TACs) was first introduced in 1974, and the amounts were progressively reduced as the stock declined in the mid-1970s.

During the 1980s, the fixed gear (longline, gillnets) fishery declined severely, and the fishery was mainly conducted by mobile gear (otter trawl) until it was closed in September 1993, due to low stock abundance. The fishery was re-opened in 1999 with a total allowable catch of 6,000 t which included 700 t for DFO's annual sentinel surveys of groundfish. Reported landings in 1999 were 5,878 t. This fishery was concentrated close to shore in the Miscou Bank-Shediac Valley, north of PEI, western shore of Cape Breton and the edge of the Laurentian Channel near 4Vn. The 1999 DFO sentinel survey indicates that stock abundance continues to be low.



Cod were caught in cod directed fisheries and as a by-catch in fisheries directed at other species, mainly flatfish. Fisheries in which cod were taken as a by-catch (winter flounder, witch flounder and American plaice fisheries) were closed if the by-catch exceeded 25% per fishing trip. Fixed gear fisheries were closed if the catch of cod exceeded 10% or 500 kg by weight in the shark fishery and 25% and 10% by fishing trip in the American plaice and winter flounder fisheries, respectively. A recreational fishery using hook and line gear was allowed in 1999 with a five fish daily bag limit, as in 1998.





License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry
- Line

Contours
- 305 Meters
- 152 Meters
- 50m
- 150m
- 100m

- Cod
- NAFO Boundary
- Limit of Data

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery
Cod

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

White Hake (*Urophycis tenuis*)

Information on this species is taken from DFO stock status report A3-12 (1998) and Scott and Scott (1988).

Distribution and Biology

White hake is a demersal species found from southern Labrador and the Grand Banks southward to North Carolina. The species favour temperatures of 5-11^{0}C and areas of soft bottom. There are at least two different stock components in NAFO Division 4T, one occupying shallow inshore areas in summer, principally Northumberland Strait (the 'Strait' component) and another occupying deep water along the Laurentian Channel (the 'Channel' component). The extent of mixing between the two stock components is unknown. Recent data indicate that southern Gulf white hake extend outside NAFO Division 4T in winter. Concentrations of white hake occur in St. Georges Bay and at the eastern end of the Northumberland Strait, but in few other places in the southern Gulf. Population biomass increased in 1997 from the historic low reached in 1996, but remains at a very low level. Furthermore, recent surveys suggest that there has been a contraction of the geographic range, and a reduction in the relative abundance of larger hake.

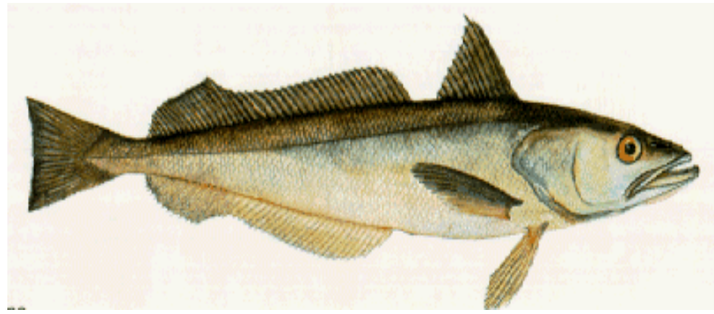
White hake are among the most fecund of commercial groundfish species, a single female may produce several million eggs. In the southern Gulf, male and female white hake reach sexual maturity at different sizes and at ages two to five years. Spawning begins in early June and peaks in the second half of the same month. The eggs are buoyant and thus planktonic. The juveniles are pelagic until about 50-60 mm long when they descend to the bottom. Juveniles hide in the sand in a water depth of 1 m, moving into deeper water as they grow. The distribution of spawning and larval fish is not well known (T. Hurlbut, DFO, pers. comm.) as surveys are typically undertaken outside of the spawning period.

White hake feed predominantly on other fish species such as red, silver and longfin hake, cod, herring, mackerel, argentines and flatfish.

The Fishery

White hake in NAFO Division 4T have historically been the third or fourth most important groundfish species in the southern Gulf. Annual landings have averaged 5,238 t since 1960. The fishery is carried out mainly by small inshore vessels and is strongly affected by weather and local market conditions. Both fixed and mobile gear is used in the hake fishery, which is concentrated in Northumberland Strait, off western P.E.I., and between P.E.I. and Cape Breton Island.

A precautionary TAC of 12,000 t was initially established for white hake in NAFO Division 4T in 1982 has been reduced on five occasions since then. Landings dropped substantially in 1993, concurrent with the closure of the cod fishery. Directed fishing for white hake in the southern Gulf has been prohibited since 1995, and daily by-catch limits have been imposed on fisheries targeting other species. A 500 t by-catch allocation in other fisheries was established in 1997. In 1997, 200 t were landed, mostly (112 t) in the sentinel fishery. Catch rates in the 1997 DFO sentinel fishery suggest that white hake were most abundant in St. Georges Bay and between eastern PEI and Cape Breton Island, but were relatively rare elsewhere. The highest catch rates were recorded with longlines in St. Georges Bay.



47°
46°
64°
63°
62°
61°
4Tl
4Tj
4Tg
4Th
Tignish
Richibucto
Mount Pleasant
Bouctouche
SUMMERSIDE
Souris
CHARLOTTETOWN
Shediac
Montague
Bayfield
MONCTON
Port Elgin
AMHERST
Tatamagouche
Pictou Island
Pictou
NEW GLASGOW
Cape George
ANTIGONISH
PORT HAWKESBURY
Port Hood
Inverness
Margaree Harbour
Grand Etang
Cheticamp
Pleasant Bay
N
W
E
S

License Areas
Corridor EL 2368
Amoco SDL-082

Transportation
Roads
Rail
Ferry

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305 Meters
152 Meters

50m
100m
150m

Hake
NAFO Boundary
Limit of Data

0 50 100
Kilometres

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Commercial Fishery
Hake

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

American Plaice
(*Hippoglossoides platessoides*)

Information on this species is derived from DFO stock status report A3-26 (2000) and Scott and Scott (1988).

Distribution and Biology

American plaice are widely distributed throughout the Northwest Atlantic, from West Greenland to the Gulf of Maine. They are found in intermediate depths (80-250 m) and cold water (usually from below 0°C to 1.5°C). The species prefers fine sand or mud bottom (Scott and Scott 1988).

Spawning occurs from early spring to summer with each female releasing hundreds of thousands of eggs. The fertilized eggs float near the water surface for several days. Plaice larvae are planktonic until they reach a minimum length of 18 mm, when metamorphosis occurs and they become benthic. Information is not available on densities or distribution of spawners due to the lack of surveys during spawning season (D. Swain, DFO, pers. comm.)

Plaice prey on a wide range of organisms throughout their life cycle: young plaice consume bottom organisms such as mysid shrimp, amphipods, polychaetes, and echinoderms (brittlestars); older plaice eat other small fish (capelin, sand lance, sculpin), echinoderms (brittlestars, sand dollars, sea urchins) and mollusks.

The Fishery

In NAFO Division 4T, American plaice have been under quota management since 1977. The resource was exploited mainly by longlines in the 1930s, but by the 1960s most landings were made by Danish seines and otter trawls. Plaice are now caught by a mix of fixed and mobile gear, with the dominant sector being Danish seines operated by vessels less than 45 feet.

Before 1993, roughly 40-60% of plaice landings were a by-catch of cod fishing. The closure of the 4T cod fishery in 1993 caused the American plaice fishery to become a mainly directed activity. Since 1993, plaice fishing has been concentrated in eastern 4T (unit areas 4Tf and 4Tg).

Although improvements have been made to fishing practices to reduce the capture of undersized plaice, some discarding persists. Projections are not possible for this stock, but recent harvest levels have not resulted in rebuilding and stock abundance continues to decline. At current stock size, fishing mortality is high relative to historical levels. Other factors indicate the need for a cautious approach to harvesting: total mortalities have not declined; and year-class strength has been poor for several years and continues to decline. Similar conditions exist in other Northwest Atlantic plaice stocks.

Atlantic Halibut (*Hippoglossus hippoglossus*)

Information on this species is derived from DFO stock status report A4-02 (2000) and Scott and Scott (1988).

Distribution and Biology

Atlantic halibut, the largest of the flatfishes, is also one of the largest marine fish species in Canadian Atlantic waters, living on or sometimes partially buried in the sea bottom. In the Northwest Atlantic, the species ranges from Virginia to Greenland including the Estuary and Gulf of St. Lawrence. In the southern Gulf, halibut concentrate in shallower water (less than 100 m) near the Miscou Bank, north of Prince Edward Island, northwest of Cape Breton Island and around the Magdalen Islands.

From observations made during DFO scientific trawl surveys conducted in January and May, it appears that Gulf halibut spawn during those periods. The spawning grounds are not defined. There is no information on densities or distribution of spawners in the area due to the lack of surveys (D. Swain, DFO, pers. comm.). According to the literature, halibut spawn at depths greater than 180 m. The planktonic phase of the egg and juvenile lasts an estimated 6-7 months, allowing dispersal of the species by ocean currents. Larvae were most abundant along the eastern and northeastern coast of Prince Edward Island. Metamorphosis to flatfish form occurs at a size of about 35-45 mm, after which Atlantic halibut become demersal.

Atlantic halibut are voracious. Juveniles feed almost exclusively on invertebrates, including krill, small crabs and shrimp. Between 30 and 70 cm, halibut eat both invertebrates and small fish, such as sand lance and gadoids. Individuals over 70 cm long feed mainly on other fishes, including plaice, redfish and gadoids. Because of their large size, active lifestyle and burrowing habit, adults are not subject to notable predation by other marine species.

The Fishery

The high landings of Atlantic halibut made during the first half of the 20th century indicate that the Gulf stock was under very strong fishing pressure. Annual catches fluctuated between 1000 t and 2000 t. Until the early 1930s, Americans made all of the catches from schooners and dories using jiggers and longlines. Mean landings were about 1300 t.

By the early 1960s halibut landings totaled about 650 t, with a record low of 91 t in 1982. A precautionary TAC limit was established in 1988. From 1992 to 1995, mean annual landings were 135 t. This drop in landings was chiefly the result of a reduction in fishing effort within the fixed gear fleet, moratoria on cod and redfish fishing, and the use of the Nordmore grate which allowed halibut to escape from shrimp trawlers. Since 1995, landings of Atlantic halibut increased to 275 t, thought to be due primarily to the increased fishing effort by the fixed gear fleet, notably longliners which take more than 80% of the total catch. The remainder is taken by gillnets and as a trawl by-catch. The most intensive fishing period is generally from April to September.

Winter Flounder (*Pseudopleuronectes americanus*)

Information provided below is taken from DFO stock status report A3-22 (1999) and Scott and Scott (1988).

Distribution and Biology

Winter flounder is a coastal flatfish found in the west Atlantic from southern Labrador to Georgia. In the southern Gulf of St. Lawrence, winter flounder are limited to waters surrounding Magdalen Islands, Chaleur Bay, the Shediac Valley-Mirimichi area, Northumberland Strait, and St. Georges Bay.

They frequent soft to moderately hard bottoms and depths less than 40 m. They are capable of withstanding temperatures ranging from below –15 °C in winter to 20 °C or higher in summer. Spawning occurs in late winter or early spring over sand or mud bottom. Female winter flounder release several hundreds of thousands of eggs that settle to the bottom, adhering to rocks and vegetation. The planktonic larvae drift in surface waters for 2-3 months before metamorphosis to the flatfish form.

Winter flounder are sight feeders, feeding opportunistically on benthic organisms, such as polychaetes, mollusks and small crustaceans. They also feed on the eggs of other bottom-spawning fish, in particular capelin and herring.

The Fishery

The fishery in 4T is prosecuted mainly by mobile gear operated by vessels less than 45 feet long, although gillnets have become more common since the mid 1980s. In the southern Gulf, winter flounder are caught in modified gillnets (tangle nets) are set on the spring and fall spawning beds of herring. Gillnets and otter trawls together took over 90% of annual landings since 1993, principally in the southeastern part of 4T (unit area 4tg).

The fishery supplies lobster bait and limited food markets. Winter flounder was also a by-catch in fisheries for cod, white hake and American plaice; however, since closure of the cod fishery, winter flounder has mainly become a directed fishery. With the closure of the Atlantic cod fishery in 1993, concern was expressed that species without quota restrictions, such as winter flounder, would be subject to increased direct effort. Landings of 4T winter flounder have declined since 1991, although the decline has been accompanied by lower fishing effort by otter trawls. Winter flounder in 4T came under quota management for the first time in 1996. DFO survey data indicate that 4T winter flounder stocks have declined to a level well below average and the average size of winter flounder is declining.

Witch Flounder ((*Glyptocephalus cynoglossus*)

Information provided below is taken from DFO stock status report A3-20 (1998) and Scott and Scott (1988).

Distribution and Biology

Witch flounder are found in the deeper waters (18-1570 m) of the North Atlantic and are associated with deep holes and the channels between banks. In the Northwest Atlantic, witch flounder range from the lower Labrador coast to Cape Hatteras. In northern areas, including the Gulf of St. Lawrence, witch flounder move into deep water during winter months and cease feeding.

Relative to other flounders, witch flounder are slow growing and long-lived. Spawning occurs from spring to late summer, depending on the region, and in the Gulf of St. Lawrence (NAFO Division 4RST), spawners aggregate in channel waters in January and February. Spawning is believed to occur in deep water in late spring or early summer. There is no information on densities or distribution of spawners due to the lack of DFO surveys during the spawning season (D. Swain, DFO, pers. comm.). Females are very fecund, releasing as many as 500,000 eggs in a single spawn.

Fertilized eggs are buoyant and hatching occurs after several days, followed by a lengthy planktonic stage that may last a year. Juveniles eventually settle to the bottom in deep waters.

The choice of prey is limited by the small mouth of the witch flounder. Food items include polychaetes, crustaceans (amphipods), small fishes and small mollusks.

The Fishery

Commercial fisheries for witch flounder developed significantly with the introduction of otter trawling to Newfoundland in the 1940s. Gulf of St. Lawrence stocks were first exploited in the 1950s when declining stocks caused Danish seiners in Fortune Bay,

Newfoundland to move to St. Georges Bay. The witch fishery expanded in the Gulf from St. Georges Bay during the 1970s to the Esquiman Channel and the northern shores of Cape Breton Island. Danish seines are the dominant gear in this fishery and account for 85% or more of the catch.

During the 1980s, 4T landings were increasingly dominated by Gulf witch landings. The 4T fishery in 1996 was characterized by frequent closures due to high cod by-catch, but closures were infrequent in 1997 due to an increase in allowable cod by-catch and were applied to individual vessels rather than to the entire fleet. Opening of the fishery is delayed until late May to avoid high cod by-catch during the migration into the Gulf.

Yellowtail Flounder (*Limanda ferruginea*)

Information on this species is from DFO stock status report A3-16 (1999) and Scott and Scott (1988).

Distribution and Biology

Yellowtail flounder range from Labrador to Chesapeake Bay. In the southern Gulf of St. Lawrence, they are common around Magdalen Islands, Chaleur Bay, the Shediac Valley-Miramichi area, Northumberland Strait, and St. Georges Bay. They live on sand or sand and mud bottoms on shallow banks, usually at depths of 40-90 m and temperatures between 2-6° C.

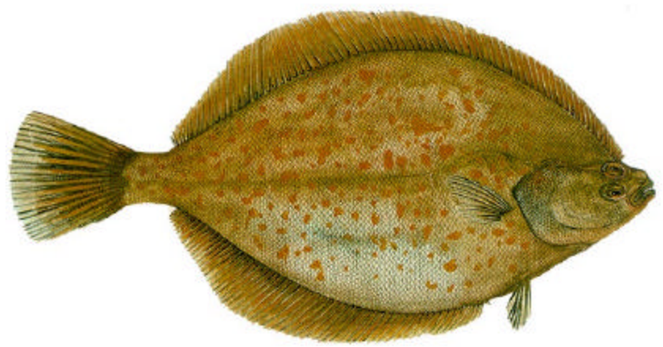
Throughout their range, they migrate seasonally into shallower waters in spring and back to deeper waters in winter. Spawning occurs on or near the bottom in spring or early summer. Female yellowtail deposit large numbers (350,000 to 4,570,000) of small eggs that float to the surface once fertilized. The eggs hatch in about 5 days and the young metamorphosis into flatfish form at 11.6 to 16.0 mm. Growth rates vary widely between regions. There is little information on the biology of yellowtail flounder in 4T.

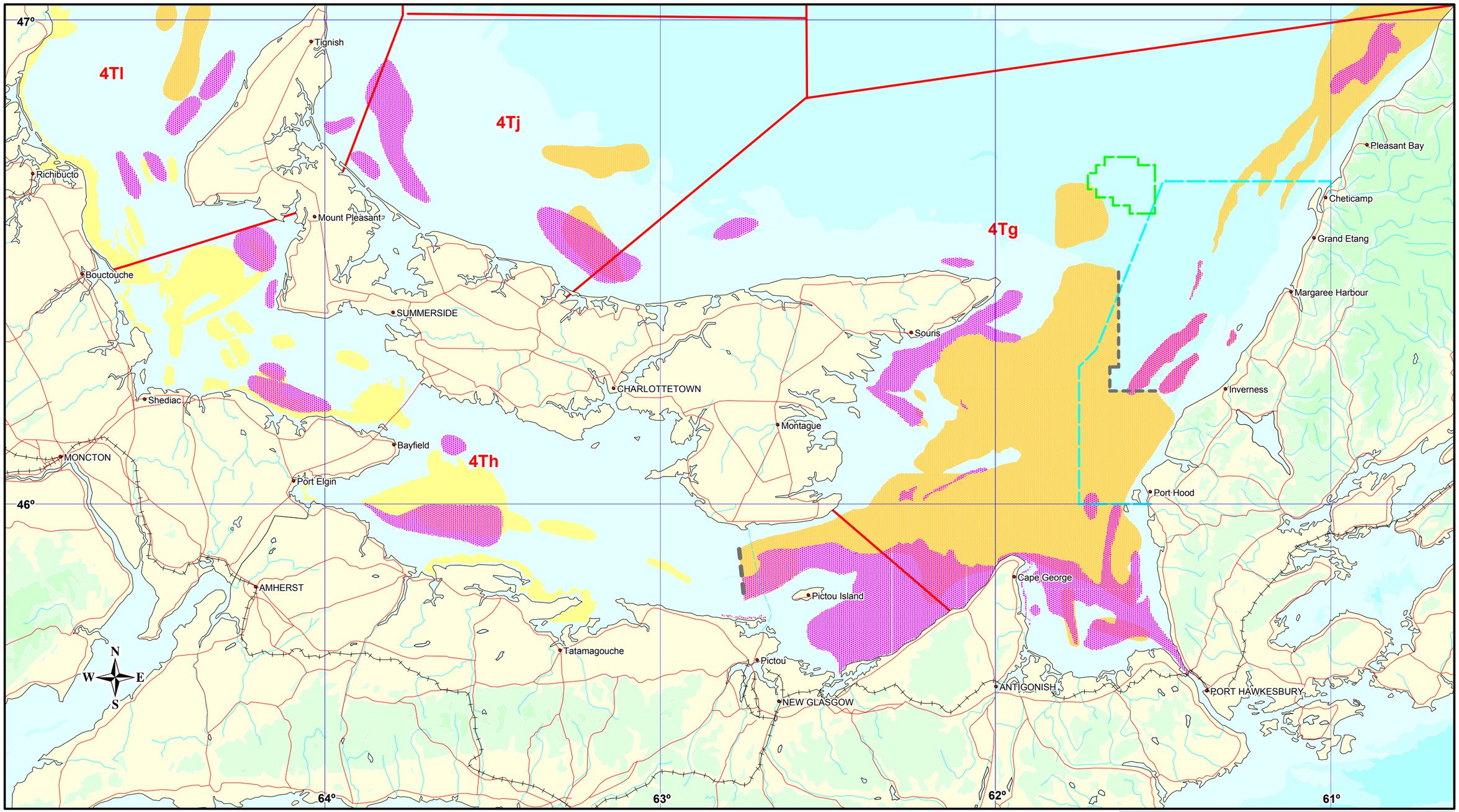
The small mouth of yellowtail flounder restricts its prey to polychaete worms and small crustaceans such as amphipods and shrimp. They feed on lesser quantities of fish such as sand lance.

The Fishery

The 4T yellowtail flounder supports localized bait fisheries and is a by-catch in fisheries for cod, white hake, American plaice and winter flounder. The fish are captured mainly by seines and otter trawls operated by vessels less than 45 feet around Magdalen Islands, off the northeast coast of New Brunswick, and the north coast of Prince Edward Island largely in the summer and fall months

A TAC of 300 t was set for the first time on yellowtail flounder taken around Magdalen Islands. A minimum size limit was also set. Fisheries were closed when yellowtail flounder shorter than 25 cm in length exceeded 15% by number of the total yellowtail flounder catch. Abundance of 4T yellowtail was stable from 1985 to 1996.





License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- Plaice
- Winter Flounder
- Flounder (Mixed Species)
- Limit of Data

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery Flounder Species

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Snow Crab (*Chionoecetes opilio*)

Information is derived from DFO stock status reports C3-01 (DFO 2000), C3-64 (2001) and Scarratt (1982).

Biology

Snow crabs occur at depths of 50-400 m, from west Greenland to the Gulf of Maine. They are abundant in the Gulf of St. Lawrence and around Cape Breton Island. Snow crabs are most commonly found on mud or sand-mud bottoms at temperatures ranging from 0-4.5 °C and at depths ranging from 50 to 280 m. Small crabs may be found on gravelly bottom at shallower depths than large crabs.

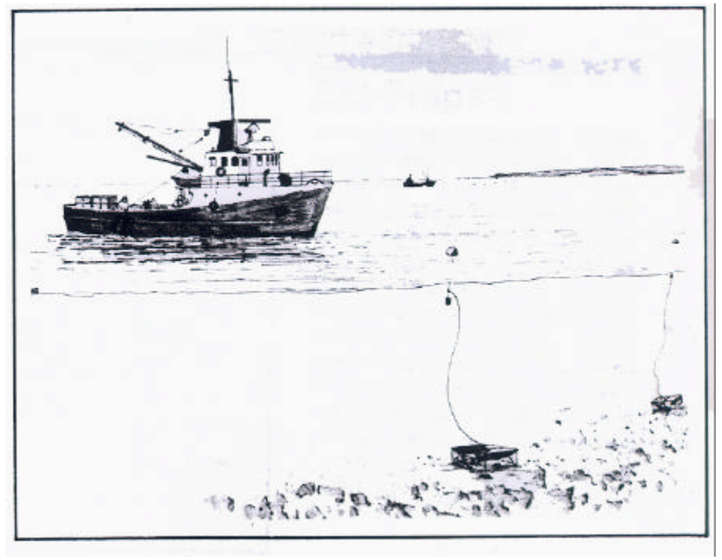
Snow crabs have a flat almost circular body and five pairs of spider-like legs. The hard outer shell is shed periodically. New shell remains soft for a period of time. Unlike lobsters, snow crabs do not continue to molt throughout their lives. Females do not molt after they have reached maturity when they acquire a wide abdomen for carrying eggs. This occurs at shell widths considerably less than 95 mm, the legal size limit. Male snow crabs stop growing after the molt, in which they acquire large claws on the first pair of legs. This can occur at shell widths as small as 40 mm, but is usually much greater. It takes at least eight-nine years for snow crab males to reach legal market size.

Mating likely occurs in spring and early summer between mature hard-shelled males and soft-shelled females recently molted to maturity. Female crabs produce eggs that are carried beneath the abdomen for approximately two years. The eggs hatch in late spring or early summer and the tiny newly-hatched crab larvae spend 12-15 weeks floating freely near the surface while they develop. During this period they molt twice, changing form and growing. At the end of this period, they settle on the bottom. There is no information on spawning or snow crab larval distribution in the Gulf of St. Lawrence (M. Moriyasu, DFO, pers. comm).

Snow crabs are omnivorous and prey include marine bivalves, worms, small crustaceans, brittle stars, fish and detritus.

The Fishery

Snow crabs are fished from 13 to 25 m boats typically using 1.5 m x 1.5 m x 0.6 m square wire or tubular steel traps with two entrances, covered with netting and baited. Fishers off western Cape Breton use 6 to 12 m boats and large lobster traps, Japanese conical traps or small square traps.



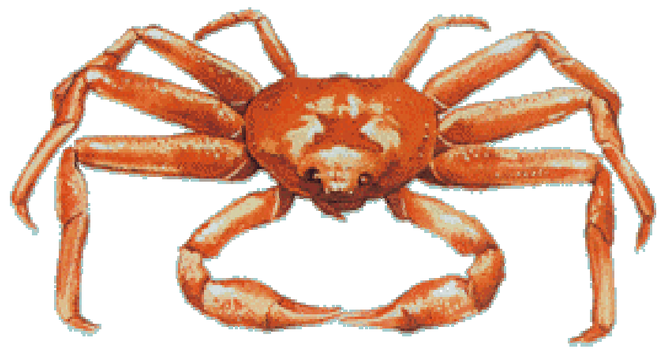
Management of this fishery is based on quotas and effort controls (number of licenses, trap limits, seasons). Snow crab fishery Management Areas 12, 18 and 19 are encompassed within the study area. In 1997, the PEI coastal snow crab fishery Areas 25 and 26 were integrated into Area 12 to form one management unit. Areas 18 and 19 delineate fishing grounds along the west coast of Cape Breton; both areas extend 35 km from the shore.

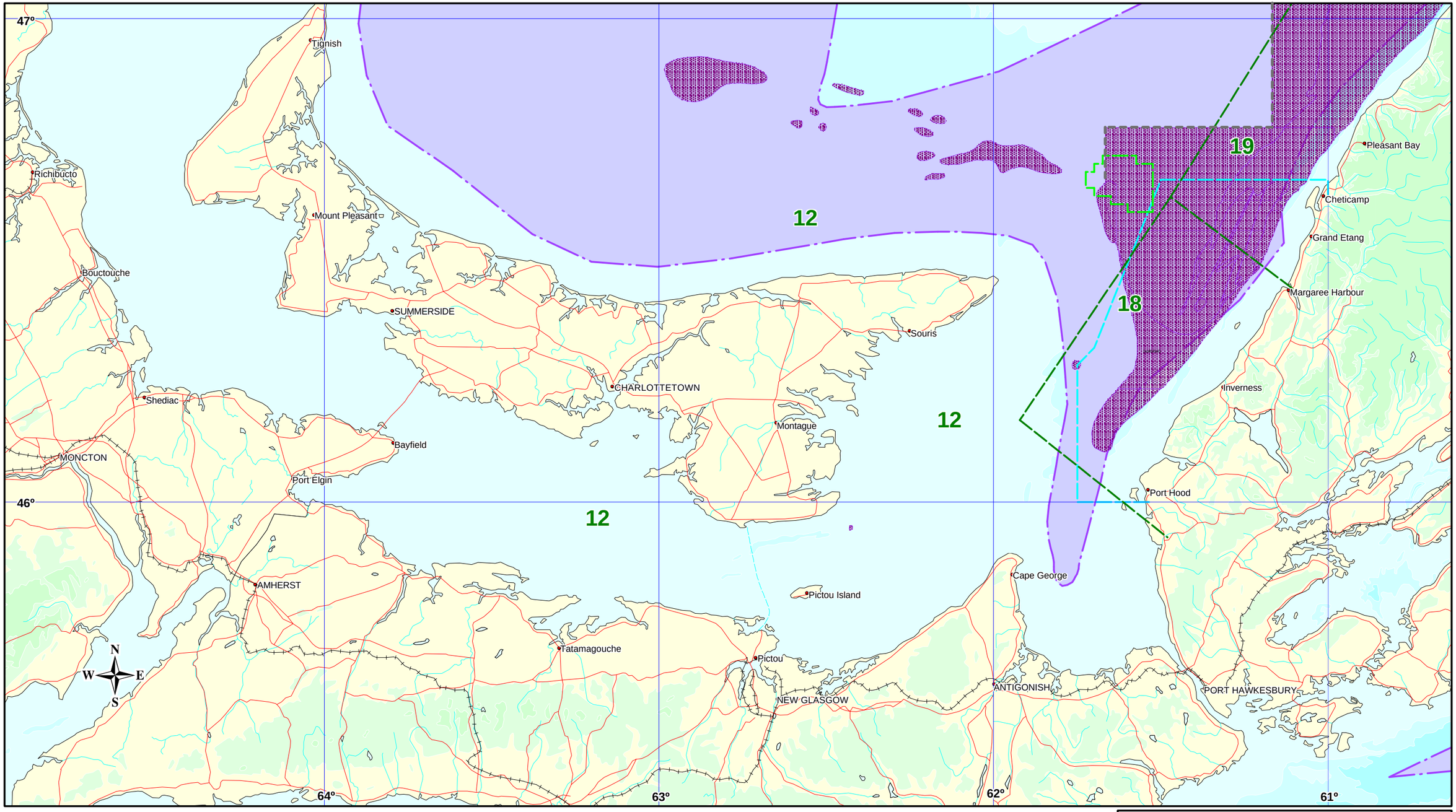
The fishery takes place in spring (starts April 20) and early summer in Area 12 and late summer in Areas 18 and 19 (starts July 1). Neither soft-shelled nor white (clean, hard shell) crabs are harvested.

Snow crabs in Area 12 are fished by registered midshore fishers from New Brunswick, Quebec and Nova Scotia each with a limit of 150 traps. Snow crabs in Areas 18 and 19 are harvested by inshore fishers from Cheticamp, Quebec and New Brunswick each with a limit of 30 traps. The majority of the fishing effort is concentrated north of Cheticamp. Of the 12 Nova Scotia ports, Cheticamp, Inverness, Pleasant Bay, Grand Etang and Mabou Harbour account for 90 to 99% of the total annual landings.

The Gulf snow crab fishery began in the 1960s and by 1988 showed signs of collapse. The stock is beginning to recover with management of the resource. In Area 12, snow crab landings peaked in 1982 at 31,500 t, fluctuated around 25,000 t until 1986 then declined to 11,700 t in 1987. In 1989, the fishery was closed due to high proportion of soft-shelled crab. The fishery re-opened in 1990 with a quota of 7,000 t. The 1995 quota was set at 20,000 t. Between 1996 and 1999 the quota has fluctuated between 16,100 and 11,125 t. The landings for 2000 were 8,752 t for the midshore fleet and 756 for inshore PEI fishers.

Landings in Area 18 were relatively consistent between 1981 and 1995 at an average annual quota of 720 t. In 1997 the quota began to decrease and the 2000 quota is 476 t with landings of 472 t. Area 19 has significantly higher landings and quotas. Landings fluctuated between 900 t and 1,390 t from 1979 to 1991. During 1992-1994 quotas were set at 1,686 t followed by a decreasing trend to 1,386 t by 1997. Since then the quota has increased to 3,370 t for 2000; the landings were 3,225 t.





License Areas

- Corridor EL 2368
- Amoco SDL-082

Transportation

- Roads
- Rail
- Ferry

Contours

- 305 Meters
- 152 Meters

- 50m
- 100m
- 150m

- Snow Crab Distribution
- Commercial Snow Crab Fishery
- Crab Fishery Areas
- Limit of Data

0 50 100

Kilometres

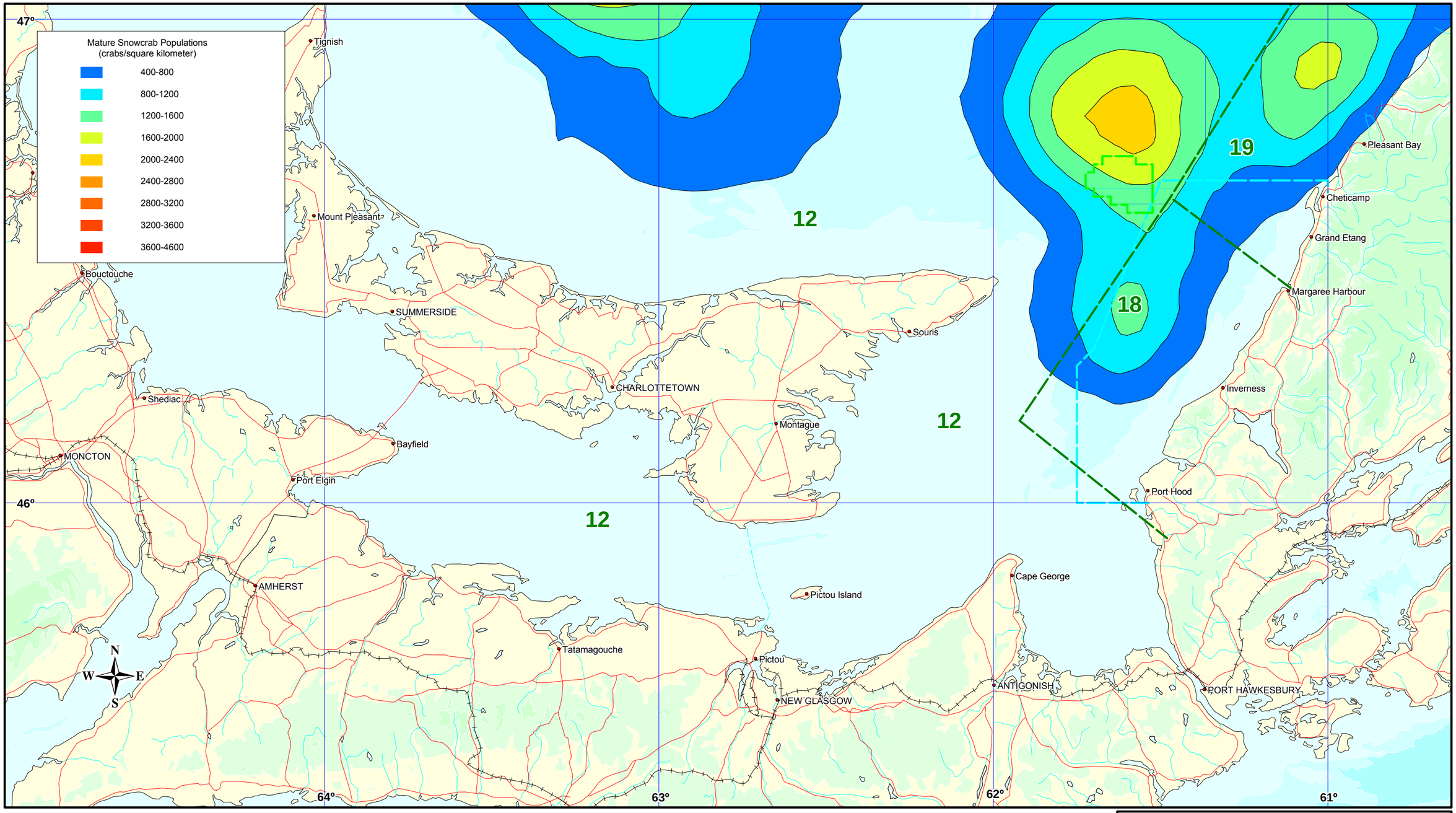
Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery & Distribution Snow Crab

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./ Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

Fishery Management Areas

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Projected Snow Crab Densities

Data Source: Projected Commerical Snow Crab Densities,
Department of Fisheries and Oceans
Gulf Fisheries Center, Moncton, NB

Map Projection: Geographic (Lat./ Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Toad Crabs
(*Hyas araneus* and *H. coarctacus)*

Two species of toad crab occur in the Gulf of St. Lawrence, *Hyas araneus* and *H. coarctacus*. Other common names are policeman crab, sea toad, spider crab and Atlantic lyre crab. Information is derived from DFO stock status report 96/99F and discussions with W. Landsburgh, a DFO crab biologist.

Distribution and Biology

Information is limited as they are not considered an important commercial species and little research has been conducted on this species in the Gulf (W. Landsburgh, pers. comm.).

They are distributed from Rhode Island to the Arctic. Both species are found at depths ranging from the intertidal zone to 60 metres. *H. araneus* prefers soft bottom habitats and *H. coarctatus* inhabits hard bottom.

Toad crabs can be distinguished from snow crabs by differences in the shell which is violin-shaped rather than oval or round. Toad crab shells are longer than wide. Their walking legs are quite long like snow crabs, but are tubular, not flattened. *H. araneus* is the larger with a shell carapace width up to 94 mm; *H. coarctatus* carapace width measures to 31 mm.

Toad crabs prey on amphipods, polychaetes, bivalves, brittle stars, gastropods, chitons, sea urchins, and small crabs.

The Fishery

A limited harvest commenced in 1994 off northern New Brunswick and northern Prince Edward Island, initially, as a by-catch of the lobster fishery. Traps are modified from the design of lobster and snow crab traps. Trap numbers are limited and only males may be caught. Twenty six licences have been issued. Total annual landings are around 388 tonnes from July to November.

Rock Crab (*Cancer irroratus*)

Information on this species is derived from DFO stock status report 96/98E.

Distribution and Biology

Rock crabs from the intertidal zone to a depth of 40 metres. Larvae are released into the water between mid-June and mid-September. The planktonic zoeal stages last for a few weeks prior to metamorphosis and settlement. There are no significant spawning areas and no evidence of larval retention mechanisms (D. Scarratt, pers. comm.). Male rock crabs take six years to reach commercial size.

Rock crabs exhibit a wide range of feeding habits and diets combining predation upon polychaetes, other crustaceans and scavenging for bivalves.

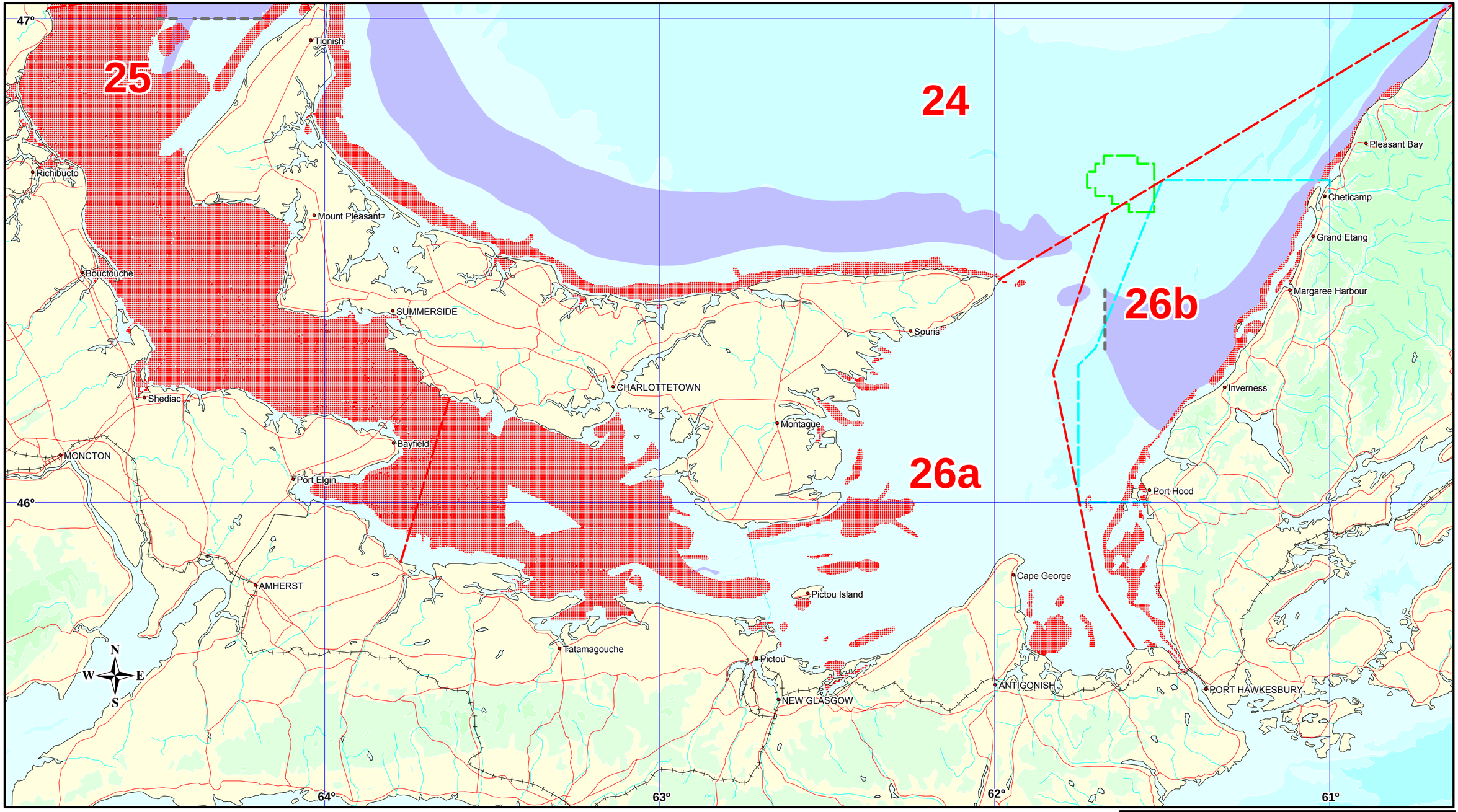
The Fishery

There are five rock crab fishing areas in the southern Gulf of St. Lawrence; four within the study boundary. These correspond to lobster fishing areas 24, 25, 26A and 25B. The rock crab fishery started in the 1960s as a by-catch of the lobster fishery taking whole rock crab for retail or processing and crushed for use as lobster bait. A limited, directed exploratory fishery began in 1974 and expanded in the late 1980s following increased market demand and value.

Crab fishing is managed through size and sex restrictions (only male rock crabs are permitted for capture), limited entry, trap limits and season. In 2000, there were 255 licenses in the directed fishery with total landings of 4,032 t.. Trap limits vary between 100 and 150 depending on the area.

Management of Rock Crab Fishery

LFA	Trap Limit	Season
24	150	July 4 – Dec 31
25 spring	125	May 1 – July 30
25 fall	125	Oct 12 – Dec 31
26 A	100	Aug 1 – Nov 15
26 B	100	July 15 – Dec 31



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- Rock Crab
- Toad Crab
- Lobster Fishing Areas
- Limit of Data

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery
Rock & Toad Crab

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Lobster (*Homarus americanus*)

Information provided below is taken from the DFO stock status report C3-12 (1998) and Scarratt (1982).

Distribution and Biology

The American lobster ranges along the Atlantic coast from North Carolina to Labrador. In the southern Gulf of St. Lawrence, lobsters are typically found in depths ranging from 1 to 40 metres. Inshore lobsters migrate short distances seasonally from deep water (15-18 m) in winter to shallower waters (7-9 m) in summer. Lobsters appear to have a limited home range of approximately 2.2 km.

Adults prefer rocky bottom habitat and live in burrows and crevices for shelter. On sand or mud, lobsters may be found hiding under rocks. The most common substrate for inshore lobsters is sand with overlying boulders. Very large lobsters may roam freely. Feeding typically occurs at night and they prey upon worms, clams, mussels, sea urchins, starfish, chitons and other bottom animals.

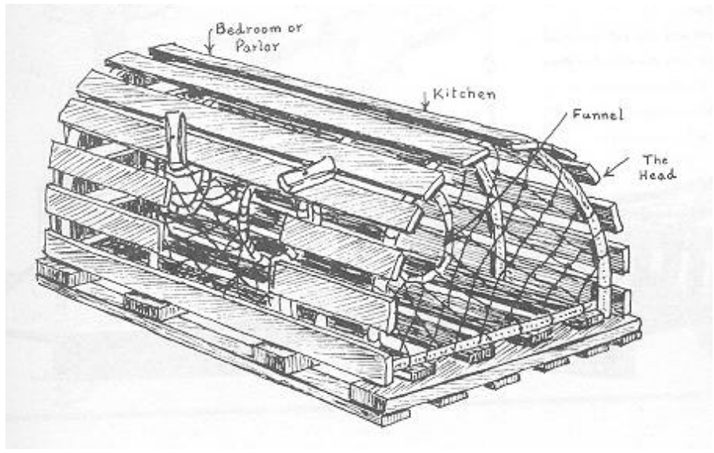
The life history of the lobster is divided into benthic and planktonic phases. Female lobsters in the southern Gulf of St. Lawrence become sexually mature after five to six years of growth. Males become sexually mature at a smaller size and younger than females. Mating occurs between the months of July and September. Generally, female lobsters extrude eggs one year after mating and carry the eggs, attached under the abdomen, for nearly another year.

The planktonic stage follows the hatching of the eggs during the months of July and August. The larvae will go through the free swimming period which includes four stages, which last a total of three to ten weeks depending on water temperature. The planktonic phase (4th stage) ends when the larvae settle on the seafloor.

There are no lobster larvae retention areas or significant lobster spawning grounds (D. Scarratt and M. Lanteigne, DFO, pers. comm.). Larvae are widely distributed throughout the southern Gulf and Northumberland Strait.

The Fishery

Lobsters are harvested between May and June in LFAs 24 and 26, followed by a summer fishery from August to October in LFA 25. Lobster are caught in purpose-built traps constructed either of wood or vinyl coated wire. Traditionally lobster traps are set along a string of five or six, up to perhaps 20 traps per string. They are set in water as little as two to three metres deep out to perhaps 30 m deep. The location of the traps is changed day to day depending on lobster behaviour which is not entirely predictable. The numbers and density of traps can seriously impede other commercial vessel traffic in the nearshore area.

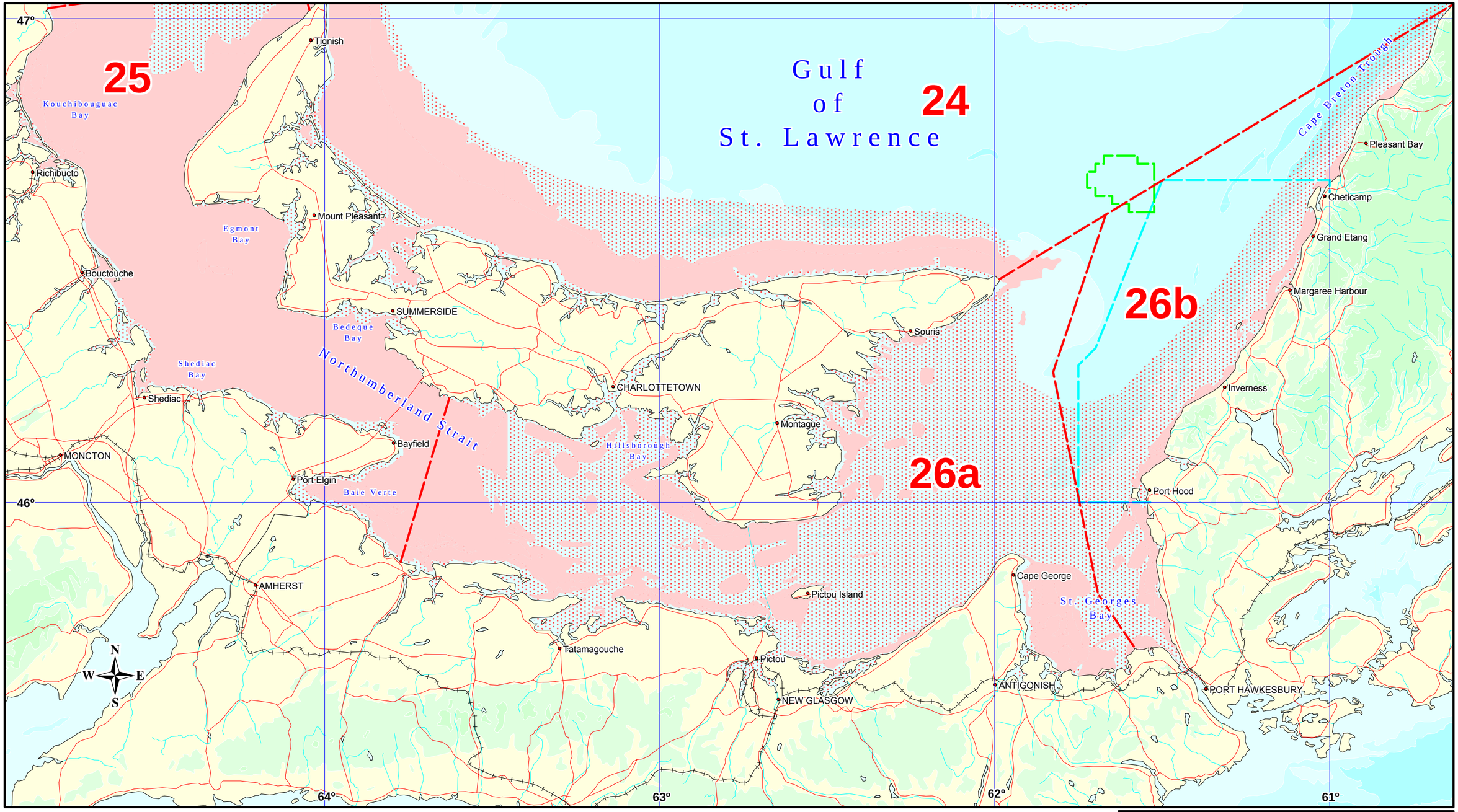


For over 100 years, the lobster fishery has been a major factor in the social and economic development of communities along the Atlantic coast. In recent years, there is increasing participation by native fishers, however, the information presented here describes traditional lobster fishery, and does not include activities of First Nations.

In 1997, the 2,527 license holders in LFAs 24, 25, 26A and 26B alone have caught 13,101 t of lobster. The number of license holders and landings in 2000 were similar.

Lobster Management in the Study Area

Lobster Fishing Area	Minimum Carapace Size	Fishing Season	# of License Holders	Maximum # of Traps / Fisher
LFA24	63.5 mm	May-June	637	300
LFA25	66.7 mm	Mid-Aug to mid Oct.	867	250
LFA26A	65.1 mm	May-June	767	300
LFA26B	70.0 mm	May-June	256	300



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- Lobster Fishing
- Lobster Distribution
- Lobster Fishing Areas

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery & Distribution of American Lobster

Data Source: Lobster Movement Database, Coastal Invertebrates Section, Dept. of Fisheries & Oceans, Moncton, NB

Gulf of St. Lawrence Traditional Knowledge Mapping Series, Dept. of Fisheries & Oceans, Moncton, NB

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Sea Scallop (*Placopecten magellanicus*)

Information provided below is taken from DFO stock status report C3-16 (1998).

Distribution and Biology

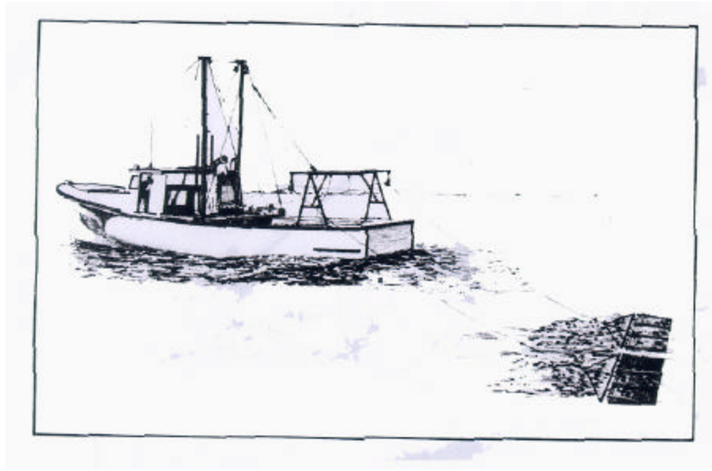
The giant scallop is found only in the north-western Atlantic from Cape Hatteras to the Strait of Belle Isle. In recent surveys of the southern Gulf of St. Lawrence, concentrations of scallops were found in two areas: off Cape Tormentine, and in the area from West Point, PEI to near Escuminac, NB. Few scallops were found near Egmont Bay or off Richibucto – two areas where scallops were formerly abundant. There are some attempts at enhancing scallop populations by capturing scallop seed (spat), allowing them to grow in "nursery" conditions, then scattering them in designated areas from future capture by scallop fishers.

In the southern Gulf of St. Lawrence scallops occur between depths of about 5 and 40 m on a wide range of hard bottom types, but are uncommon on mud or silt. Water temperatures above 20-23°C are usually lethal to sea scallops and are a possible cause of occasional mass mortalities of adult scallops in the southern Gulf.

Scallops spawn as early as age two but do not produce many eggs until they are larger than 70 mm (four to five years old). Sexes are separate and egg fertilization is external. Spawning usually occurs during late summer and the larvae are planktonic for four to five weeks before they metamorphose and settle to the bottom in mid-autumn. Settlement is often patchy and variable due to variation in egg and larval survival, suitability of bottom type available at the time of metamorphosis and the effects of wind, currents and tide on larval distribution. Scallops in the southern Gulf reach harvestable size at age four or five.

The Fishery

The main scallop beds in the study area are in Northumberland Strait. A small fishery also occurs on the north side of PEI and western Cape Breton. Most fishers in the southern Gulf of St. Lawrence use modified Digby dredges, which are the most efficient gear on rocky and gravel bottoms. Scallops are fished widely through the southern Gulf but their distribution changes unpredictably as beds are fished out and new ones develop elsewhere.

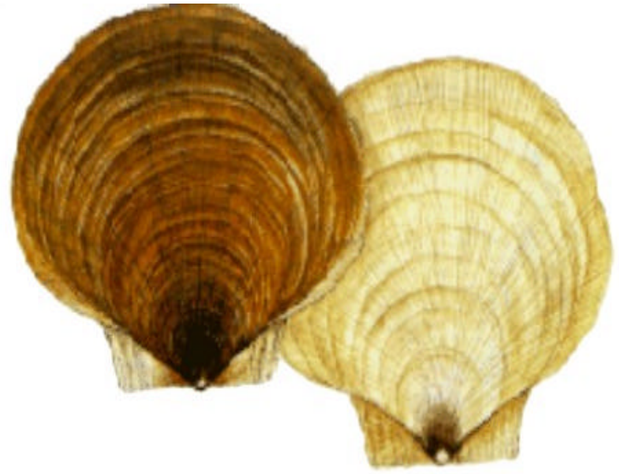


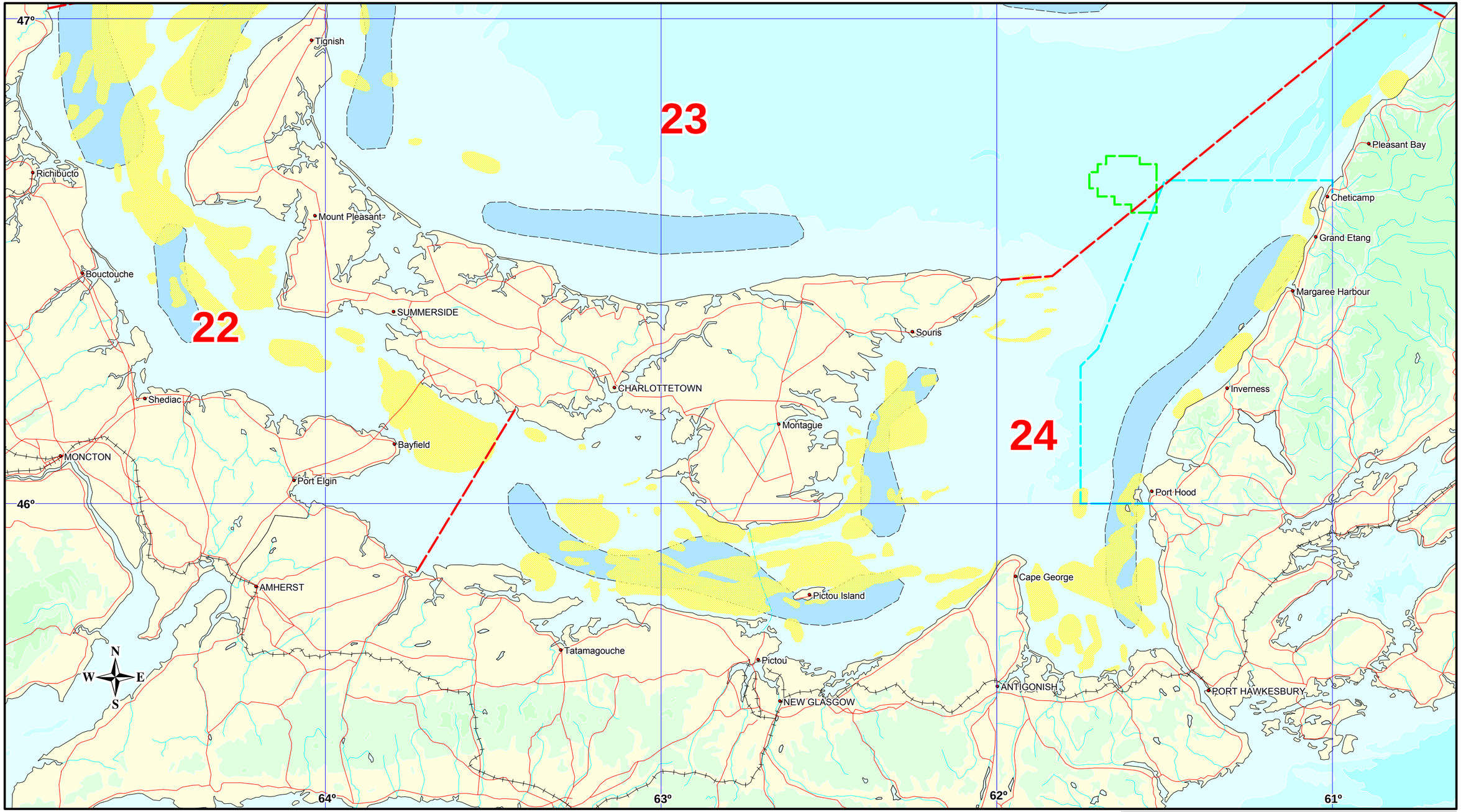
In the 2000 season there were 755 licenses for scallop fishing areas (SFAs) 22, 23 and 24. Area 22 and 23 have one fishing season during the summer. Area 24 has three fishing seasons spread over the spring and winter. In 2000, 1,665 t of scallop meats were landed in SFAs 22-24.

1997 Southern Gulf of St. Lawrence Scallop Fishing Licenses and Seasons

Fishing Area	No. of Licenses	Fishing Season
SFA 22	202	May 5 – June 7
SFA 23	79	June 1 – Nov. 29
SFA 24	391	Apr 14 - 18, May 5 - June 14, Oct 13 – Dec 31

The DFO survey suggests stock abundance of scallops in SFA 22 during 1997 was low compared with other years and with other scallop areas in Maritime Canada. The average catch per standard tow in 1997 was the lowest ever recorded. This low abundance suggests that the 202 licenses in SFA 22 exceeds the limits of the resource.





License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- Scallop Fishery
- Scallop Distribution
- Scallop Fishery Areas

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery & Distribution Scallop

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998); DFO Science Branch, Moncton Fisheries Centre

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Shellfish Closure Areas

A variety of shellfish, primarily molluscs, are harvested recreationally from beaches and rocky coastlines, or grown commercially in aquaculture facilities. These include the bivalves: bar or surf clam (*Spisula solidissima*), Atlantic oyster (*Crassostrea virginica*), whelk (*Buccinium undatum*), bay quahaug (*Mercenaria mercenaria*), blue mussel (*Mytilus edulis*), and soft-shell clam (*Mya arenaria*).

Shellfish Toxins

Sometimes during the summer and late fall, toxic phytoplankton species multiply in large quantities (bloom). Bivalves filter these organisms for food and subsequently concentrate the toxin in their tissues but are themselves immune to the effects of the poison. Consumption of toxic shellfish may lead to illness or death. Once the plankton bloom is over and the organisms' abundance decreases, the shellfish flush themselves of the toxin through normal feeding and respiration.

There are three types of shellfish poisoning Paralytic Shellfish Poisoning (PSP) and Amnesic Shellfish Poisoning (ASP) and Diarrhetic Shellfish Poisoning (DSP).

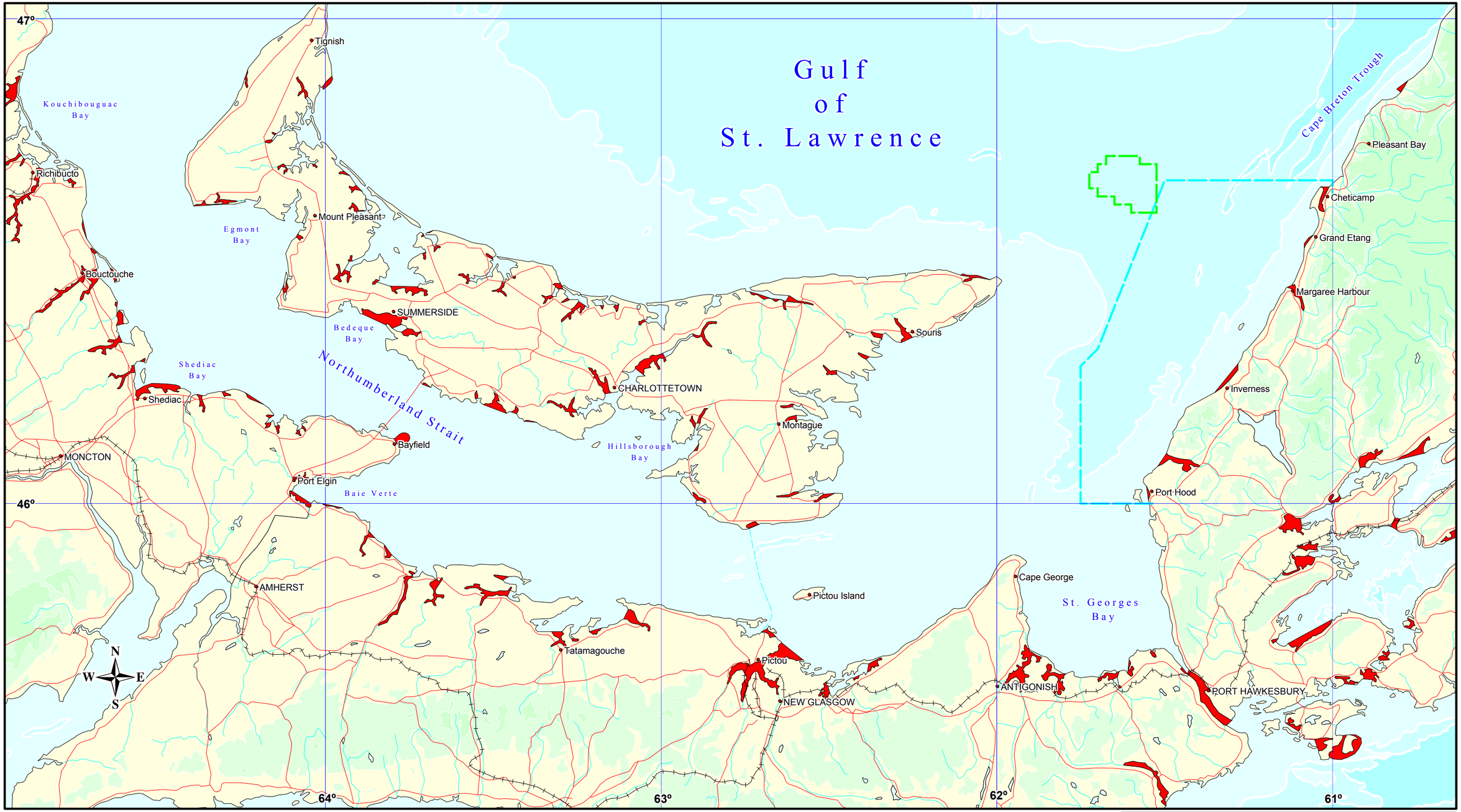
Fisheries and Oceans Canada maintains information pertaining to shellfish toxins and seasonal locations of areas of concern. This information is not available for mapping. Such information resides with local fishery officers. Shellfish are routinely tested to ensure that are not harvested and sold when toxins are present at unacceptable concentrations.

Bacteriological Contamination

Almost every harbour and estuary in the study area is closed to shellfish harvesting as a result of bacteriological contamination. Bacteriological contamination of coastal harvesting areas is generally caused by waste discharges. Sources of this contamination include:

1. municipal and industrial wastes;
2. drainage from agricultural pastures and feedlots;
3. excrement from wild animals and birds;
4. discharges from pleasure craft and fishing boats.

The coastal areas shown on the map are designated closed by Environment Canada for shellfish harvesting due to bacteriological contamination. This information is updated every three years, but classifications may be updated more frequently if contaminated product is marketed.



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

Shellfish Closure Areas

0 50 100
Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Shellfish Closures

Data Source: Shellfish Growing Area Classification Index (www.ns.ec.gc.ca/epb/sfish/maps/class.html)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Atlantic Salmon (*Salmo salar*)

Information on this species is taken from DFO stock status reports D3-05 (1999), D3-07 (1998), D3-08 (1998) and D3-09 (1998).

Distribution and Biology

Atlantic salmon is an anadromous species. Adults spawn in fall, burying the fertilized eggs in "redds" in the gravel of streams and rivers. The eggs hatch in early spring. The newly hatched fry have a prominent yolk sac from which they draw nourishment until the digestive system is sufficiently developed for them to start feeding. Most juvenile salmon (parr) spend two to three years in the river before migrating to the ocean in the spring. This seaward migration is accompanied by a dramatic change in the fish's physiology, smoltification, which permits it to live in salt water as opposed to fresh water. Once in the ocean, the salmon disperse throughout the Gulf into the Atlantic Ocean. After one to three years in the sea, the salmon return as mature fish to the stream in which the originally were spawned. Adult fish which survive spawning may pass the winter in the river and return to sea the following spring as "black salmon" or kelts.

Spawning populations consist of varying proportions of small (grilse) and large salmon. Grilse are fish which have spent one year at sea before returning to spawn (one-sea winter (1SW) salmon). The large salmon component contains a mixture of fish which have spent two years at sea and occasionally spawners which are returning for a second or more spawning (multi-sea winter (MSW)). Salmon undertake extensive marine migrations to Labrador, Greenland and Faroe Islands and return as large fish. Grilse travel less extensively to Labrador, Newfoundland and the Grand Banks.

One distinct stock of salmon occupy the greater part of the northwest and southern Gulf and migrate to sea through Cabot Strait; the other stock in the northeast Gulf migrate through Strait of Belle Isle. Of the former stock, those migrating up the Restigouche River are early run spring fish. The other stock are late run (late summer and fall) fish.

Returns of both 1SW and MSW salmon to many of Atlantic Canada's rivers decreased in 1997. Recently reviewed factors which have the potential to affect survival include changes in marine fish communities, forage and predators such as large sea birds and seals.

The Fishery

Traditionally, there was a commercial harvest for salmon conducted with trap nets and drift nets along the coasts of New Brunswick, Nova Scotia and Prince Edward Island. The commercial fishery was closed in 1984 due to severe population declines throughout the region. The salmon fishery is now exclusively an angling recreational fishery except for Aboriginal fishing.

There are three designated management areas within the study area (salmon fishing areas 16, 17 and 18).

SFA 16 – New Brunswick

Management area SFA 16 has 41 rivers with Atlantic salmon stocks. The Miramichi River is the largest and contains 90% of the salmon-producing habitat in SFA 16 supporting several discrete stocks. This river is outside of the study area.

Spawning habitat on the Bouctouche River appears to be limited in quality and extent. Parr are generally found throughout the river with the highest concentrations in the South Branch but abundance is low. A spawning run of Atlantic salmon (approximately two thirds multi-sea winter fish) enters the Bouctouche River during September and October (G Atkinson et al. 2000).

Fishing agreements for subsistence and ceremonial purposes have been signed with five of six First Nations having access to salmon in SFA 16 rivers. Harvests were in most cases less than agreed upon allocations. Since 1998 rivers in the Kent and Westmorland counties of the Northumberland Strait shore of SFA 16 have been closed to all salmon fisheries. This was based on the fact that salmon egg depositions in the Boutouche River were well below conservation requirements.

SFA 17 – Prince Edward Island

Prince Edward Island's original Atlantic salmon stocks were largely eliminated in the 19th century by overexploitation and habitat destruction from agricultural, forestry, and road construction practices. Since the mid 1980s, community groups and government agencies have targeted several streams for intensive habitat enhancement and regular stocking. The salmon rehabilitation program has been most successful on the Morell River, which currently accounts for the bulk of PEI's returning salmon, harvested salmon, and salmon rod-days. Enhancement and stocking efforts have been directed at the Mill, Trout, Dunk, West, and Vallyfield Rivers, but returns on these rivers are lower that those of the Morell River.

SFA 18 – Nova Scotia Northumberland Strait and Western Cape Breton

Fifteen rivers on the Northumberland Strait shore of Nova Scotia support Atlantic salmon stocks. Salmon typically enter these rivers in late autumn, usually after September 15. Headwaters of rivers draining the Cape Breton Highlands have steep gradients and on a unit area basis produce more salmon then other rivers on Cape Breton Island. Margaree River supports the largest of the Island's salmon stocks. Stock composition varies with summer (20-40%) and fall (60-80%) components, each comprising of 70-80% MSW salmon.

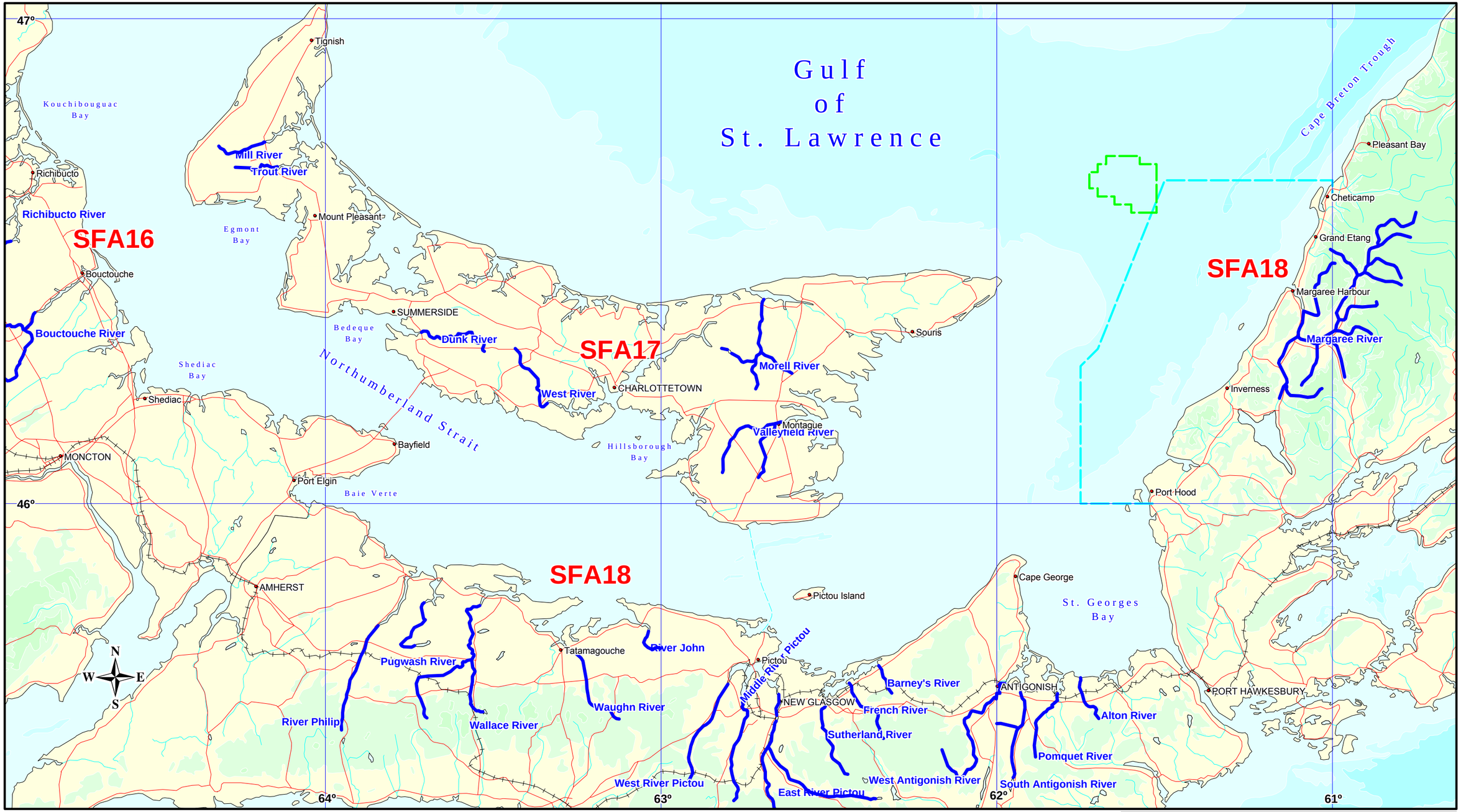
Aboriginal and sport fisheries occur on several rivers in the area including East River Pictou, River Philip, River John, South River, Wallace River and West River Antigonish. Salmon angling seasons have not changed for several years (September 1 to October 31).

Five Aboriginal groups (the Native Council of Nova Scotia, and Indian Brook, Millbrook, Pictou Landing and Afton First Nations) either harvested salmon from Northumberland Strait rivers or had the rivers listed in their respective fishing plans or licenses. Pictou Landing reported harvests on East River, Pictou. Millbrook First Nation harvested fish on River Philip. Similar to previous years, the total harvest by Aboriginal groups in 1997 was low.

Allocations totaling 1,130 small, 700 large and 100 black salmon were made to the five First Nations of Cape Breton Island. Of the total, 130 small and 650 large fish were targeted from the Margaree River.

The recreational fishery for salmon on Cape Breton in 1997 was restricted to hook-and-release, with the exception of Margaree River where anglers could retain grilse (<63cm) June 1 – October 31. Margaree River attracted 88% of the Island's recreational fishing effort for salmon.

Probable Atlantic Salmon Migration Routes into the Gulf of St. Lawrence



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

Atlantic Salmon Rivers

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Atlantic Salmon Rivers

Data Source: Department of Fisheries and Oceans
Stock Status Report D3-05, 07, 08, 09

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

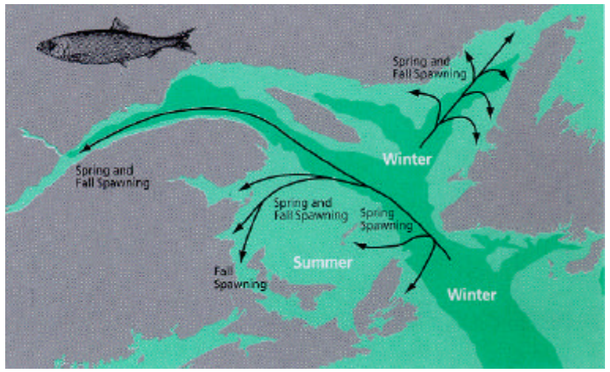
Herring (*Clupea harengus harengus*)

Information has been taken from DFO Science Stock Status Report B3-01 (2000) and Scott and Scott (1988).

Distribution and Biology

Herring is a pelagic species which forms schools during feeding and spawning periods. The management stock area for southern Gulf of St. Lawrence herring extends from the north shore of the GaspJ Peninsula to the northern tip of Cape Breton Island and includes the Magdalen Shallows. Adults overwinter off the east coast of Cape Breton.

The southern Gulf of St. Lawrence stock consists of two components: spring and fall spawners. Spring spawning occurs primarily in May but extends into June in depths <10m. Fall spawning occurs from mid-August to mid-September at depths 5 to 20 m. The largest spring spawning populations are off Escuminac, NB (north of this study area) and the southeast New Brunswick area. The largest fall spawning population is further north in Chaleur Bay.



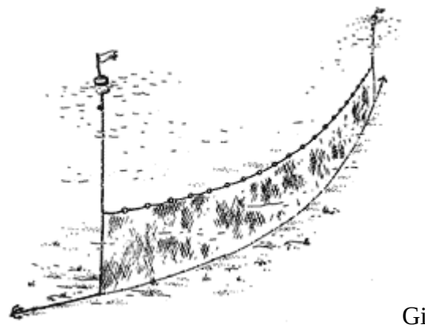
Migration routes and spawning areas of Atlantic herring in the Gulf (White and Johns 1997)

After the eggs are released by the female and fertilized by the male, they remain attached on bottom, usually on seaweed, until hatching. Spring spawned eggs hatch in about 30 days, fall spawned eggs hatch in about 10 days due to warmer conditions. There is little recent information on larval distribution (C. Leblanc, DFO, pers.comm.). Messiah (1975) identified nursery areas by catches of juvenile and immature herring. Surface circulation disperses larval herring southwards and eastwards of spawning grounds.

Herring are visual feeders; their main food source is plankton. As larvae, they feed on small phytoplankton. With increase in size, they consume copepods, euphausiids, fish eggs, pteropods, mollusk and fish larvae.

The Fishery

Herring are harvested on spawning grounds by an inshore gillnet fleet and in deeper water by purse seiners (vessels >65 ft). Gillnets are constructed of monofilament netting and may be secured to the bottom with weights or left to drift. Nets that are anchored have buoys on each end to indicate location and ownership, and to provide a means to retrieve the gear. Nets are positioned relative to location of the fish. A bottom sounder is used to detect fish schools.



Gillnet

Purse seining entails encircling a fish school in a wall of netting. A small boat (skiff) is launched from the vessel taking one end of the seine. The skiff encircles the fish and returns back to the vessel with the end line to winch in the cable to close the bottom of the seine. A bag-like net is formed. Other lines are winched in reducing the size of the enclosure. The fish are dipped out and placed in the vessel's hold.

In the 2000 season in the southern Gulf of St. Lawrence, there were approximately 2,640 inshore licenses and 6 active seiners (>65'). The inshore fleet harvests >97% of the stock. The purse seine fleet harvests spring spawners in the area between Cape Breton Island and the Magdalen Islands. In the fall, the purse seine fleet concentrates in Chaleur Bay. Total landings in 2000 were 69,188 tonnes.

The primary market for the fall inshore fleet is the roe market. The market for the spring fishery is for bait and bloater (smoked herring) markets. There is a small experimental fishery uses trapnets for collecting roe-on-kelp off Escuminac and southeast New Brunswick in May-June.

Atlantic Mackerel (*Scomber scombrus*)

Information has been taken from DFO stock status report B4-04 (DFO 2000) as Scott and Scott (1988).

Distribution and Biology

In the northwest Atlantic, mackerel occur from Cape Hatteras to the Gulf of St. Lawrence and the east coast of Newfoundland. It is a strongly schooling species and one of the most active of migratory fishes. Adults migrate into the Gulf from the Atlantic Ocean in spring and leave the Gulf back into the Atlantic between September and November. Changes in migration patterns are caused mainly by fish sensitivity to certain environmental conditions, particularly water temperature.

Spawning takes place each year after a long migration that begins some months earlier in the Georges Bank area. The spawning stock

in the region is large and includes fish which spawn along the coast of Nova Scotia and possibly on the Grand Banks of Newfoundland, the main stock spawns primarily in the Gulf of St. Lawrence in June and July (F. Gregoire, DFO, pers. comm.). Mackerel larvae are common in the Magdalen Shallows, north of the study area. According to the 1998 egg abundance survey, the spawning biomass of the Gulf of St. Lawrence mackerel was about 300,000 t.

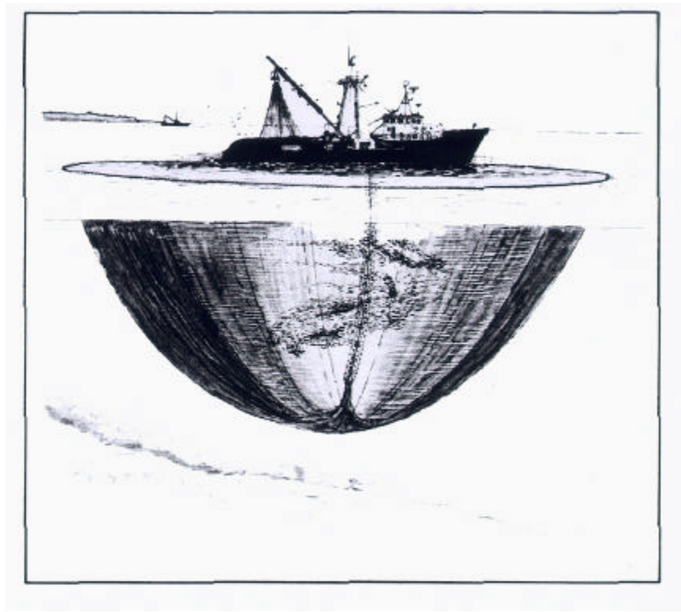
The highest egg concentrations are always found south of the Laurentian Channel and west of the Magdalen Islands. Each female spawns several times during the spawning season. Spawning takes place at any time of the day and night. Egg development time depends on water temperature. The eggs hatch in 5-7 days at 11-14º C. Larvae measure about 3 mm long upon hatching. At 50 mm in length, young mackerel become juveniles and begin to form schools. Some of these schools are found in inshore waters. Little is known about the size of the juvenile contingent that participates in this migration or the importance of coastal habitats for juveniles.

Although mackerel feed primarily on plankton, the adult diet includes small fish and squid.

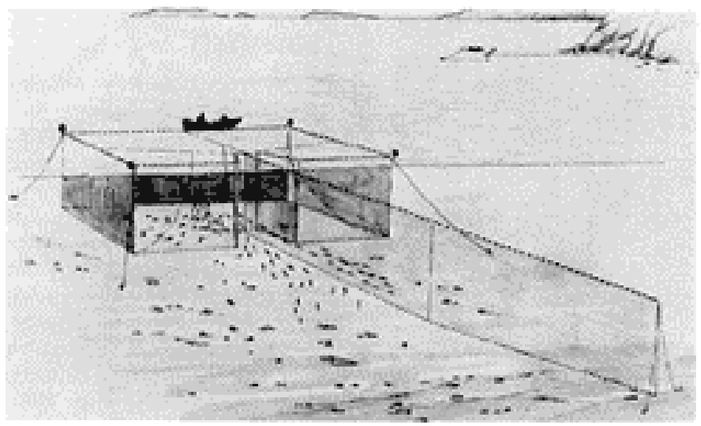
The Fishery

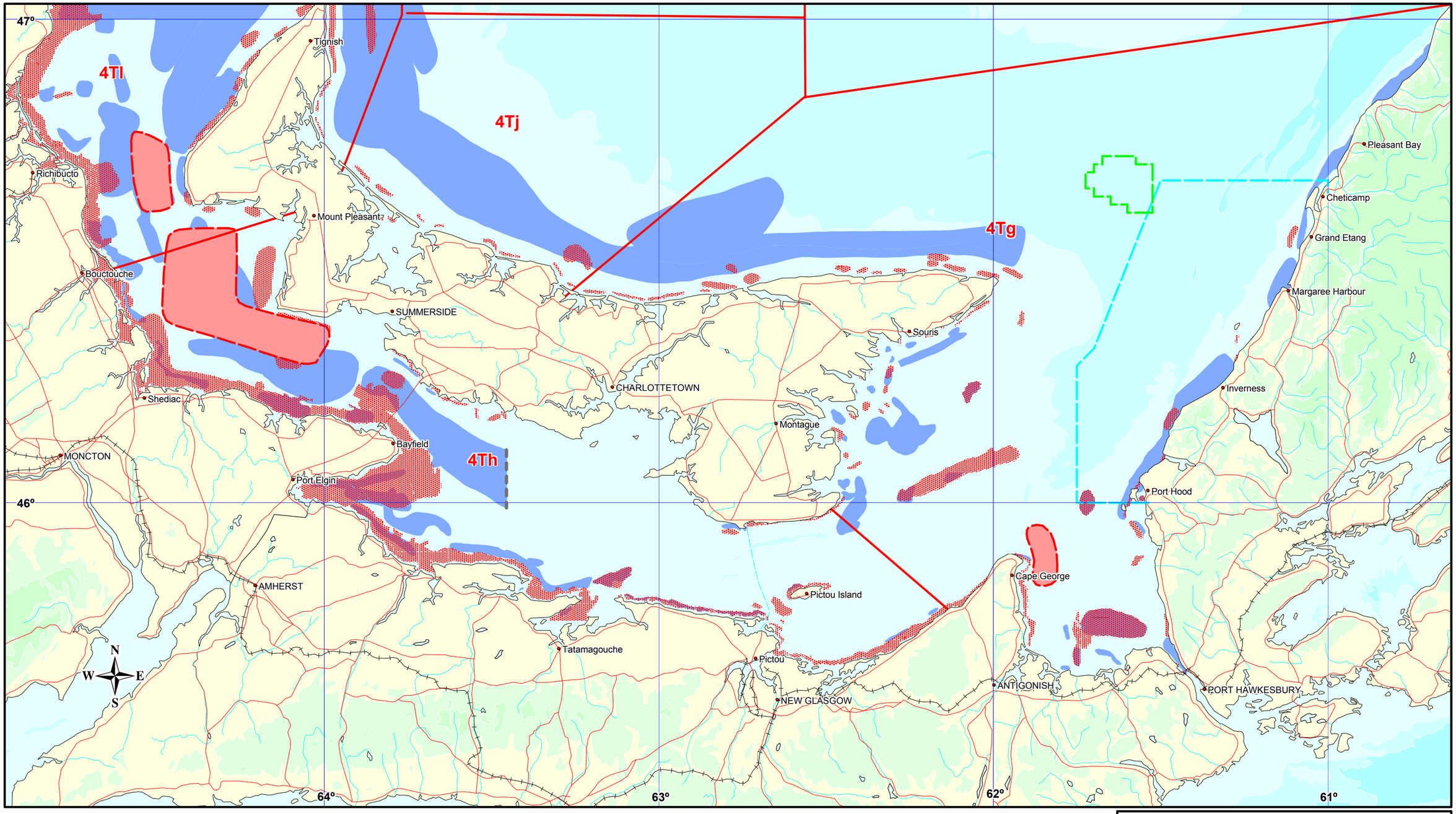
There are 2,646 licenced mackerel fishers in the southern Gulf of St. Lawrence. Catches of mackerel used as bait do not appear in DFO's statistics which are based on processing plant purchase receipts. Recreational fishing is not counted as there is no requirement for registration or licensing.

Mackerel are predominantly fished inshore with gillnets, purse seines, handlines and traps depending on the area and time of year. Gillnets are used mainly in the spring and handlines are used in the fall. Mackerel traps are also important and used predominantly in the spring. Traps and weirs are used along the Cape Breton shore. The fishing season usually opens June 1, though the 1999 fishery opened earlier as the fish arrived earlier.



The success of this fishery is strongly dependent on environmental conditions, including water temperature and prevailing winds. Total mackerel landings in NAFO areas 4Tj, 4Tg, 4Th and 4Tl in 2000 was 5,840 t. Fluctuations within statistical districts are due to seasonal migration patterns. Nova Scotia and Newfoundland have the highest mean landings.





License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- Mackerel
- Herring
- Herring Nursery Area
- Limit of Data

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery Mackerel & Herring

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)
Messieh, 1975

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Bluefin Tuna (*Thunnus thynnus*)

Information on bluefin tuna is taken from Scott and Scott (1988) and DFO (1988, 1999). Stock status is monitored by the International Commission for the Conservation of Atlantic Tunas (ICCAT).

Distribution and Biology

Bluefin tuna is the largest of the mackerel-type fishes, large specimens may weigh more than 500 kg. In summer they migrate onto the Scotian Shelf, off Newfoundland and in the Gulf of St. Lawrence. They occur in water depths of 27-183 m, often in schools of less than 50 fish. The ability to thermoregulate body temperature enables this warmwater species to occupy cool northern waters where they seek schools of herring, capelin, mackerel and squid. The broad diet and habitat preferences make them very adaptable to changes in habitat.

The combination of their schooling behaviour, the patchiness of their prey, and age-specific preference for waters of particular temperatures account for the considerable year-to-year variation in fishing location.

The Fishery

Bluefin tuna were first harvested as a game fish in eastern Canada with the establishment of the International Tuna Cup Matches at Wedgeport, NS in the late 1930s. The management of bluefin tuna in the North Atlantic is governed by the ICCAT because this species migrates to the waters of many countries and must be internationally managed.

Tuna fishing in the Gulf of St. Lawrence was first developed off Prince Edward Island (North Lake and Rustico) in 1967 and in Chaleur Bay in 1973 and St. Georges Bay in 1978.

Historically, the bluefin tuna fisheries have used sport rod and reel, trap nets, harpoon, longlines and purse seine. Since 1980, a method called tended line or keg fishing, which involves a single hook on a length of buoyed rope tied to the vessel. Currently, most fish are taken on rod and reel and tended lines.

In 1999, 606 bluefin tuna licences were used in the Gulf Fisheries Management Region: 360 licences from PEI, 111 from New Brunswick and 135 from the Gulf area of Nova Scotia. The fishery usually commences in late July and concludes in late November. A quota of 35 tonnes is allocated to each fleet in separate tuna management areas for Gulf New Brunswick, Gulf Nova Scotia and Prince Edward Island. A reserve of 50 t is established for the traditional late season fishery in St. Georges Bay.

Five tuna licences issued to Aboriginal groups in Atlantic Canada are included within the Gulf Nova Scotia fleet and enjoy the same licence conditions as that fleet.

47°
46°
64°
63°
62°
61°
Tignish
Richibucto
Mount Pleasant
Bouctouche
SUMMERSIDE
Souris
CHARLOTTETOWN
Shediac
Montague
Bayfield
MONCTON
Port Elgin
AMHERST
Pictou Island
Cape George
Tatamagouche
Pictou
ANTIGONISH
NEW GLASGOW
PORT HAWKESBURY
Pleasant Bay
Cheticamp
Grand Etang
Margaree Harbour
Inverness
Port Hood
N
W
E
S

License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters

- 50m
- 100m
- 150m

- Extended Tuna Fishing Boundary
- Primary Tuna Fishing

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery
Tuna

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Gaspereau
(*Alosa pseudoharengus* and *A. aestivalis*)

Information on gaspereau is taken from DFO stock status report D3-17 (1997).

Biology and Distribution

The alewife and blueback herring are anadromous clupeids that spawn in many Maritime rivers and lakes. They are collectively referred to as gaspereau. Blueback herring occur in fewer rivers and are generally less abundant than alewives where both species co-occur. Spawning migrations of alewives typically begin in late April or early May, depending upon geographic area and water temperature, peak in late May or early June and are completed by late June or early July. Blueback herring enter the river about two weeks later than alewives. Both species return to sea soon after spawning. Young-of-the-year gaspereau spend, at most, the first summer and fall in fresh water before migrating to the sea. Both species recruit to the spawning stock over two-four years. Spawning occurs first in both species at age three and virtually all fish have spawned by age six.

Repeat spawners may form a high proportion (35-90%) of the stocks of both species, with higher proportions of repeat spawners where exploitation is low.

The Fishery

Gaspereau are harvested by gill, trap, and dip nets depending upon the river and location within the river system, e.g., gill net in the river mouth, dip net in the lower river, and trap net in lake areas. Special tip-traps are used in the Margaree River.

The gaspereau fishery is regulated by season, gear, and licence restrictions. Few new licences have been issued since 1993. Individual licences include several and different gear units. The primary measures restricting exploitation rates are limiting of licences to existing levels in all areas, and a two-day closure each week. Variations from the general closures and restrictions are instituted under river-specific management plans.

Gaspereau fisheries in the Maritimes are geographically and economically diverse. Reliable harvest information is available only for a few of the larger fisheries. In many areas, gaspereau used locally as bait for other fisheries may not be registered in the purchase slip database.

Reported landings from the Maritimes peaked in 1980 at just under 11,600 t. A second peak in 1988 of just under 10,500 t has been followed by a continuous decline to less than 5,000 t in 1996. In the last ten years, the Southern Gulf harvests have represented between 45% and 71% of the total Maritime harvest.

In most parts of the Maritimes, gaspereau fisheries are relatively small (less than 100 t annually). The fishery of the Margaree River, the largest in the study area, has been monitored annually since 1983: Less intensive and generally opportunistic sampling has been conducted on fisheries on the Richibucto River.

Gulf Nova Scotia

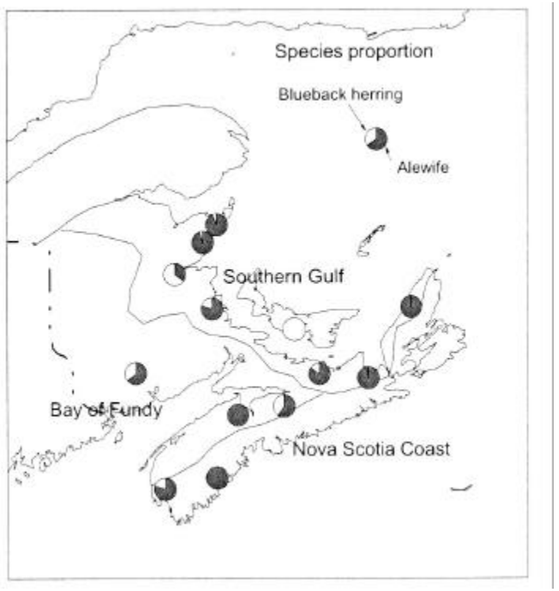
In the Margaree River, alewives make up more than 95% of the gaspereau harvest. The major run occurs in the second to fourth weeks of May. Historically, the harvest peaked in 1988, and has declined precipitously since then the reported harvest of 94 t in 1996 was the lowest since 1957.

Gulf New Brunswick

Harvests declined in the Richibucto River fishery in 1996 relative to recent ten-year averages. There were generally fewer than four age classes in the fishery with no alewives older than six years of age. Blueback herring comprise less than 25% of the harvests in the Richibucto River and less than 5% in the other rivers which is indicative on heavily exploited stocks.

Prince Edward Island

The status of gaspereau on Prince Edward Island is poorly known. Landings data are of little value because most catches are used as bait and are not recorded. There are anecdotal reports of gaspereau runs that have disappeared after periods of intensive fishing, but the extent to which overfishing may have caused local extirpations is unknown.



Proportion of alewives and blueback herring in rivers

American Eel (*Anguilla rostrata)*

Information on this species was obtained from Davis et al. (2000) and Chaput et al. (1997). There are no stock status reports for American eel in the Maritime Region.

Biology and Distribution

American eels are found in most estuaries and rivers of the Atlantic coast of North and Central America, as well as the West Indies. American eels are catadromous, meaning they mature in freshwater and travel to the sea to spawn. Between August and December, mature eels begin their seaward migration downstream, mostly travelling by night. By January through to March, they arrive in the western portion of the Sargasso Sea where they spawn and presumably die. The eggs hatch into transparent larvae which feed on plankton over the next year, and develop into the adult eel form while travelling in the Gulf Stream to the North American coast. They are known as glass eels. As they approach freshwater in May, they begin to develop pigment and become known as elvers, and are about 4 –7 cm in length (Eales, 1968).

On entering an estuary, they acclimate to freshwater. Once in freshwater, they are called yellow eels and will be yellow–olive in colour for several years. Many remain in the estuaries, or in the ocean nearby. Once in freshwater they are carnivorous, feeding at night or on dull days on the bottom, on a variety of organisms from snails to small fishes. Those that travel upstream, enter rivers in May and June, often in large numbers. In the fall, the eels will remain in the river or return to the estuary to overwinter, burrowing in soft sediment. At sexual maturity they begin their seaward migration, taking on a bronze– black colour with a silver sheen (silver eels).

The Fishery

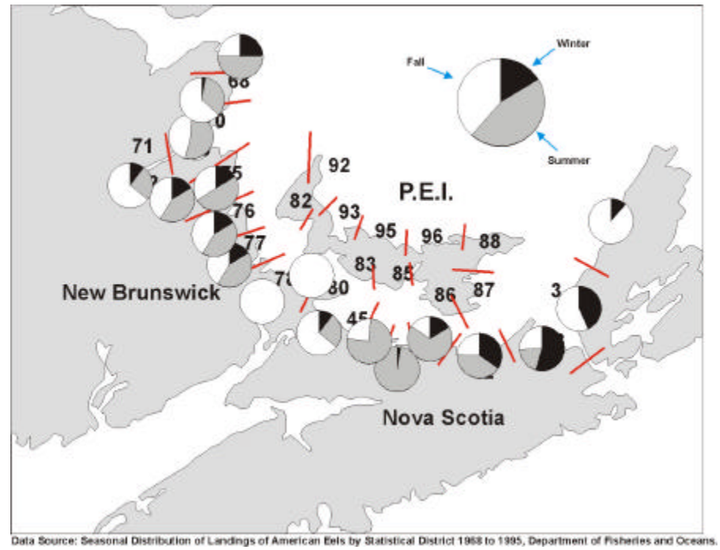
American eels were first harvested by Aboriginals as a subsistence food fishery and there has been a recreational and subsistence fishery for more than a century.

The southern Gulf of St. Lawrence rivers have important estuarine commercial fisheries capturing yellow and silver eels but relatively little is known about the species in this area (Chaput 1997). The New Brunswick fisheries account for half (60 to 210 t) of the total landings from the southern Gulf, followed by Prince Edward Island (31 to 127 t) and Nova Scotia (16 to 89 t).

Most eels are caught in summer and autumn using traps nets. Eels are also speared in winter (January to April). There appears to be an overall decline in landings from the southern Gulf. Some of the decline may be due to reduction in effort, variations in reporting rate of harvests, and variations in abundance. General decrease in catch is thought to reflect widespread population decline. Standard fisheries management approaches have not provided a clear understanding of status of the American eel. Catches in North America are declining (Locke et al. 1995). This has been attributed to a combination of four factors; changes in habitat, overfishing, chemical contamination, and a change in ocean climate (Castonguay et al, 1994).

The gear used in the fishery (Eales 1968), includes baited traps, unbaited traps, weirs, spears, trawl nets and beam trawling. Longlines are also used. All of the fishing methods rely on eel activity and are therefore not as effective during the winter when the eels are relatively inactive. Spearing through holes in the ice benefits from the inactivity of the eels at this time.

Chaput et al. (1995) stated that there was insufficient data for a stock assessment of eel in the southern Gulf of St. Lawrence eel. Commercial landings have not been reported consistently, there are no records of recreational fisheries, which may be significantly large, and there is no quantitative recording of how fishing efforts has changed over the years (Locke et al, 1997).



Seasonal Distribution of Eel Landings by Statistical District

Rainbow Smelt (*Osmerus mordax*)

Information on this species was obtained from Davis et al. (2000) and DFO stock status report D3-18 (1997) for Prince Edward Island. Stock status reports for New Brunswick and Nova Scotia are not available.

Biology and Distribution

Rainbow smelt are numerically the most abundant anadromous fish of the Gulf of St. Lawrence (Davis et al. 2000). They are relatively small, being about 13 to 15 cm at spawning. They are distributed throughout the Atlantic provinces. Their distribution includes most estuaries of the Gulf; Newfoundland is their northern limit (Scott and Scott, 1988). During summer, smelts tend to be restricted to cooler, deeper marine waters.

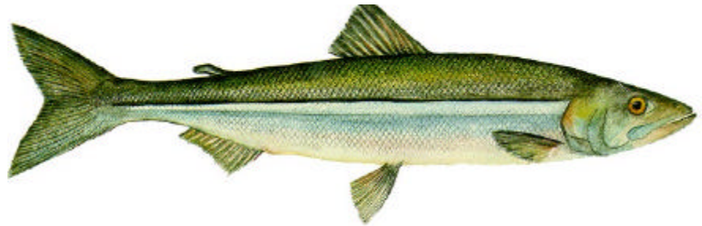
Smelt enter streams in the fall to late winter and also overwinter in estuaries. Spawning occurs in spring in freshwater. Spawning age is generally two to three years and lifespan is generally less than seven years (Chaput and Leblanc, 1996). Larvae grow rapidly, feeding on zooplankton, and copepods and then small fish.

They are an important forage food for other fish species and piscivorous birds.

The Fishery

Smelt are caught in boxnets, gillnets and bag nets for the commercial market. There is a fall fishery in the Gulf, but the winter fishery is more important. The New Brunswick smelt fishery is regulated by an October 15 to end of February season, with occasional extensions to the season. The commercial season for Prince Edward Island runs from October 1 to the end of February for gillnets and from October 15 to the end of February for box and bag nets. There is also a recreational fishery by spearing through the ice in winter, and using dipnets and gillnets in spring.

Approximately 76% of the Gulf landings are from New Brunswick. In southern St. Georges Bay smelt are landed at Antigonish, Tracadie, Pomquet, Cheticamp and Grand Etang. The landings in this area were 26,158 tonnes in 1992 and declined to the most recent catch of 2,126 tonnes. There is no set harvest limit. Reported landings on PEI totalled 98.5 t in 1996 (Cairns 1997) with the winter fishery harvesting two thirds of total landings.

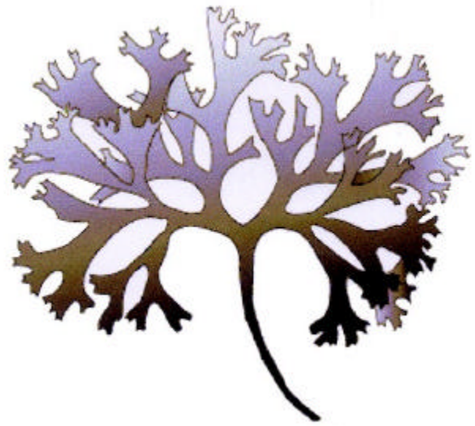


Irish Moss

Information for this species was obtained from an unpublished DFO stock status report in preparation courtesy of R. Semple (DFO, pers. comm.) and the Northwest Atlantic Fisheries Center web site.

Distribution and Biology

Irish moss (*Chondrus crispus*) is a perennial tufted red alga averaging 10 to 15 cm long at maturity. It ranges from Labrador to New Jersey, northern Russia to southern Spain as well as the western Baltic and Iceland.



In the Gulf of St. Lawrence, it is a subtidal plant growing predominantly on sandstone ledges from 1 to 12 m deep where it comprises about 70% to 90% of the algal biomass. *Chondrus* fronds are upright and dichotomously branched into fan-like blades ranging in colour from dark red or purplish brown to a bleached greenish yellow, frequently with iridescent tips. The plant is attached to the substrate by a crustose holdfast. It grows to maturity in two to three years.

The amount of suspended particulate matter in the water, tides, wave action and bottom type affect the distribution of Irish moss as these factors affect light penetration, nutrients and available space for growth.

The Fishery

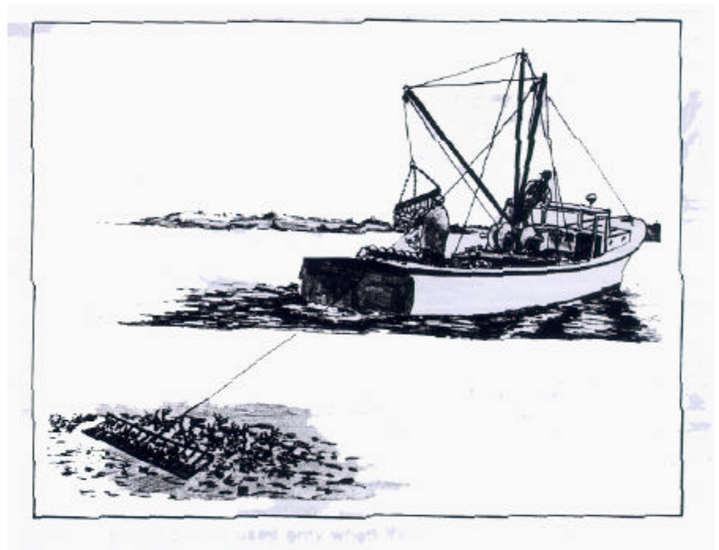
Although Irish moss occurs ubiquitously throughout eastern Canada it is commercially harvested in 12 Marine Plant Harvesting Areas. In the study area, the main harvest grounds is in MPHA 1 northwestern Prince Edward Island. The other MPHAs shown on the map are historical or infrequently harvested sites.

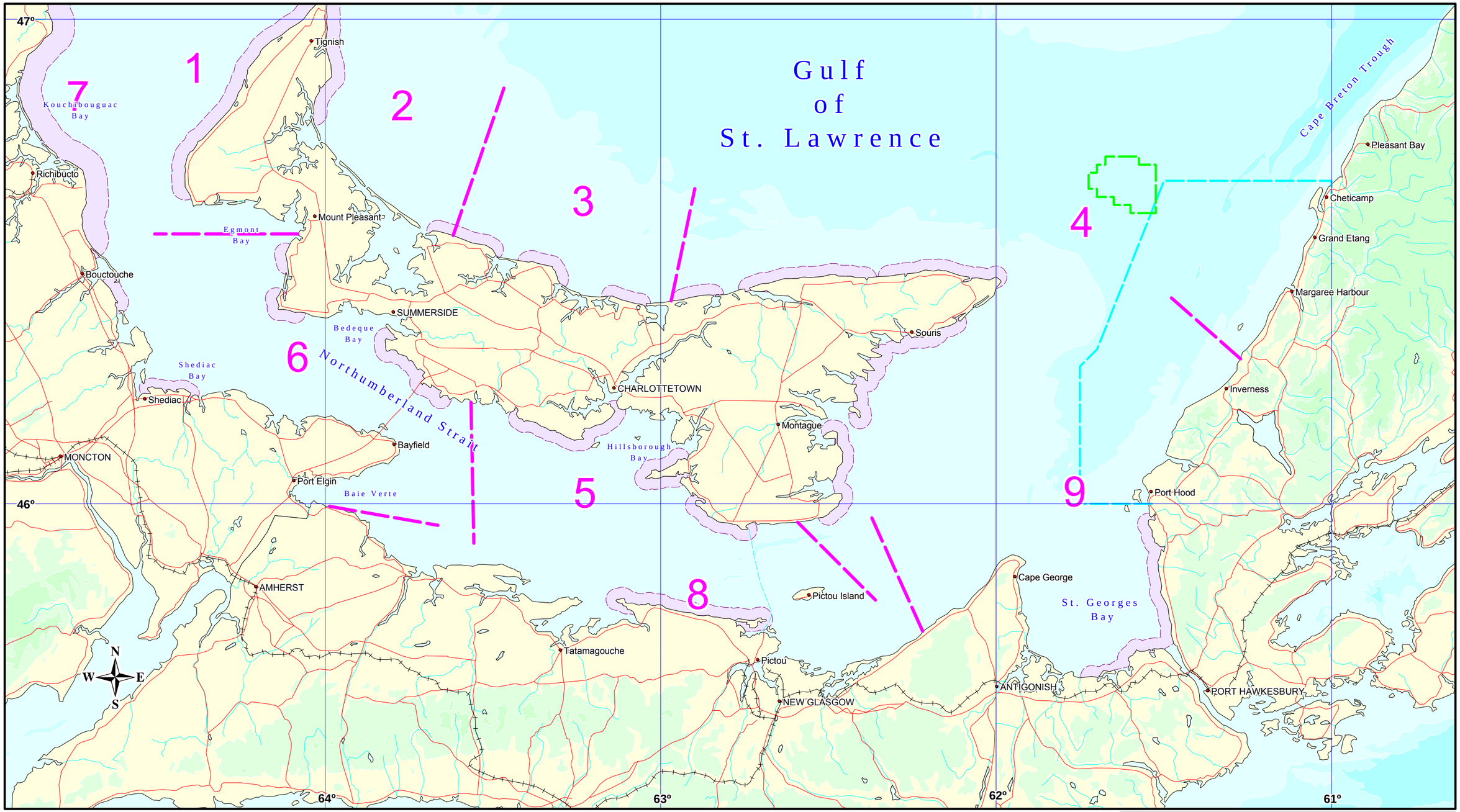
Irish moss harvesting dates are June 10 and July 1 with a closed season from October 11 to June 10. Lobster fishing seasons, weather, tides, frond growth, reproduction, carrageenan concentration and epiphyte abundance influence harvesting seasons. Irish moss is harvested by gathering unattached fronds or by cropping attached fronds with a drag or hand rake. Horses are also used to gather storm tossed moss by towing a scoop in shallow water. Dragrake boats are rigged for Irish moss harvesting. Small boats (7-10 m) use up to six dragrakes and run in a circular direction over the moss beds. The larger “wincher” boats (14 m) use rakes attached in triplicate and move in a straight course.

Fifteen percent of the world’s supply of hydrocolloids comes from carrageenin, a gelatinous carbohydrate extract from the cell walls of Irish moss. Carrageenin extract is used extensively as a thickener in dairy products, baked goods, pharmaceuticals and cosmetics. Since 1974, the demand for *Chondrus crispus* as a raw material for carrageenan (a phycolloid) has steadily declined. Initially, the reduced demand was reflected in price stagnation during the 1970s followed by a reduction in number of exporting companies, purchasing locations and duration of purchases in the 1980s.

The *Chondrus* beds off western Prince Edward Island, Marine Plant Harvesting Area (MPHA) 1, yielded steady landings during the 1970s and early 1980s and accounted for over 90% of the Gulf landings in 1995. Since 1990, Irish moss landings average 2,176 wet t. In 2000, 364 harvesters landed 6,904 t. The other MPHAs in the Gulf were active in the past but are currently underutilized.

The decrease of landings since 1989 can be attributed partially to a smaller effort as well as a decrease of 30% in active harvesting vessels. The quality of the harvest declined in the mid–1980s due to an increasing amount of the red alga *Furcellaria lumbricalis* mixing with *Chondrus*. The *Chondrus* resource in MPHA 1 must be considered as a part of a two species marine plant harvest to maintain the resource base. *Furcellaria* has reached its maximum biomass in three of the major commercial beds but there is no barrier to increasing abundance or migration to adjacent beds, which can affect the quality of *Chondrus* harvest.





License Areas

- Corridor EL 2368
- Amoco SDL-082

Transportation

- Roads
- Rail
- Ferry

Contours

- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- Seaweed Harvesting Areas (Historical - Current)
- Marine Plant Harvesting Areas

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Seaweed Harvest Areas (Historical - Current)

Data Source: R. Semple, pers. comm., DFO

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Shellfish Culture

Information on the location of aquaculture lease sites in Nova Scotia, Prince Edward Island and New Brunswick were provided by the responsible provincial government agencies.

New Brunswick

Location	Species	# of Leases
Richibucto	NA	60
Bouctouche	NA	17
Cocagne	NA	20
Shediac	NA	13
Cap-Pele	NA	1
Petit-Cap	NA	4
Cap-Jourimain	NA	5
Baie Verte	NA	1
Provincial Total 121		

The New Brunswick Department of Fisheries and Aquaculture provided geo-referenced locations of aquaculture facilities within its jurisdiction, however information on species cultured was not provided. There are eight areas with a total of 121 aquaculture leases. Richibucto Harbour has one of the largest shellfish aquaculture operations in the southern Gulf of St. Lawrence. Most established aquaculture sites in New Brunswick are located in the estuaries. The harbours of Cocagne, Bouctouche and Shediac support the majority of lease sites. Species cultivated include oysters, mussels, bar clams, quahaugs and softshell clams. There is some experimental nursery culture of scallops for fisheries enhancement.

Nova Scotia

Location	Species	# of Leases	# Leases/Location
Wallace Harbour	American Oyster	4	6
	Bay Quahog	2	
Tatamagouche Bay	American Oyster	4	8
	Bay Quahog	2	
	Blue Mussel	2	
New Glasgow	American Oyster	4	12
	Bay Quahog	5	
	Bar or Surf Clam	1	
	Bay Scallop	2	
Springhill	American Oyster	1	1
Malagash	American Oyster	13	23
	European Oyster	3	
	Clams	4	
	Quahog	3	
Lazy Bay	American Oyster	1	5
	Blue Mussel	4	
Merigomish Harbour	American Oyster	2	2
Pictou	American Oyster	1	2
	Blue Mussel	1	
Provincial Total 59			

Aquaculture sites are located in eight protected harbours along the north shore of Nova Scotia. No aquaculture sites are currently situated along the Inverness County side of Cape Breton or in Georges Bay. Fifty-nine active lease sites farm oyster, mussels, surf clams, quahaugs and scallops. The majority of lease sites are in Malagash Harbour and Pictou Harbour.

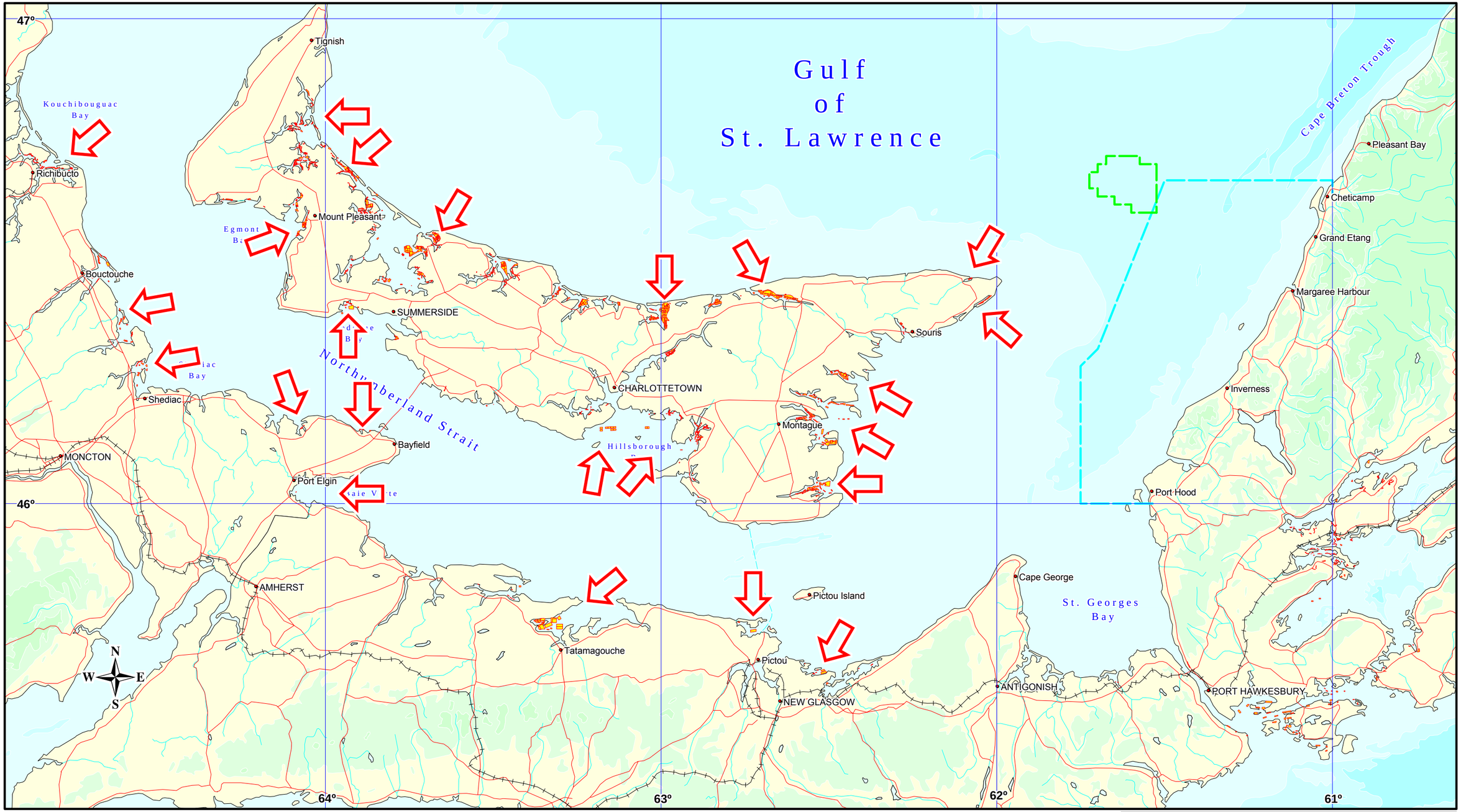
The most commonly cultivated species is American Oyster. Traditionally, the Northumberland Strait shore area of Nova Scotia has been an excellent place to grow American oysters. In 2001 one lease was obtained for European oyster.

Prince Edward Island

Location	Species	# of Leases	# Leases/Location
Malpeque Bay	Oysters	19	19
Belmont	Oysters	22	37
	Mussels	5	
	Clams	10	
Oyster Cove	Oysters	3	6
	Clams	3	
March Water	Oysters	21	47
	Clams	5	
	Mussels	21	
Cabot Beach	Oysters	1	1
Darnley Basin	Oysters	30	46
	Mussels	13	
	Clams	3	
Lennox Island	Mussels	8	79
	Oysters	71	
Conway Narrows	Oysters	77	79
	NA	2	
Cascumpec Bay	Oysters	175	181
	Mussels	4	
	Clams	2	
Wolfe Inlet	Oysters	11	11
Egmont	Oysters	36	36
Sunbury	Oysters	9	9
Salutation Cove	Oysters	3	3
Cape Traverse	NA	1	1
Richard Point	Clams	1	3
	Oysters	2	
Hillsborough	Oysters	67	78
	Mussels	11	
Squaw	Oysters	3	3
Pownal	Oysters	27	27
Orwell	Oysters	72	74
	Mussels	2	
Pinette Bay	Oysters	5	5
Gascoigne Cove	Oysters	2	2
Murray River (Harbour)	Oysters	8	40
	Mussels	32	
St. Mary's Bay	Clams	4	17
	Mussels	13	
Provincial Total 1106			

Prince Edward Island has the largest aquaculture industry. Most of the embayments along the north and eastern shores of PEI support several aquaculture leases. The lagoons, estuaries and barrier beaches along the north shore of PEI provide shelter in Malpeque Bay, Conway Narrows, Darnley Basin, Foxley Bay, Cascumpec Bay, New London Bay, Rustico Bay, Covehead Bay, Tracadie Bay and St. Peters Bay. On the eastern shore of PEI, South Lake, Souris River, Boughton River, Cardigan Bay, St. Mary's Bay and Murray Harbour support aquaculture leases. A few sites are located on the south shore in Hillsborough Bay and River, Sunbury Cove, Enmore River and Percival River.

Oyster and mussel leases are the most abundant. The majority of oyster lease sites are along the northeastern shore with only a few scattered in the southwest. A mixture of traditional bottom and off-bottom culture is used. Mussels are cultured using long lines anchored securely at both ends, and supported by floats tied at intervals along their length (NSDFA, 1999). The mussels are grown on "socks" suspended from the long lines.



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 150m
- 100m

Aquaculture Lease

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Aquaculture Lease Locations

Data Source: Nova Scotia Department of Fisheries, Fisheries & Ocean Canada - PEI, N.B. Department of Agriculture, Fisheries and Aquaculture

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Green Sea Urchin (*Stronglyocentrotus droebachiensis)*

Information on this species is obtained from DFO stock status report C3-48 (2000).

Distribution and Biology

The green sea urchin is common on shallow rocky bottom throughout Atlantic Canada. It has a spherical test (skeleton) with long moveable spines and may grow up to 75 mm in diameter. Because the principal food source is kelp the highest concentrations of urchins are found in feeding fronts bordering the edges of kelp beds. The maximum depth range is 40 to 60 m, but they are generally most abundant just below the subtidal algal fringe in 5 to 10 m water.

Spawning occurs in early spring (March-April) when water temperature and phytoplankton conditions are favourable for fertilization and embyronic and larval development. Larvae are planktonic for eight-twleve weeks before settling permanently to the bottom. They metamorphose to the initial post-larval stage within hours. Size at sexual maturity can be as small as 15 to 22 mm diameter at ages four to ten years. Urchins are harvested at around 50 mm diameter.

Bottom-founded sea urchins feed mainly on living and dead organic matter, especially large macrophytes (kelp) but will also scavenge. Primary predators of juvenile and adult sea urchins include lobster, crabs, some fish species and seabirds.

The Fishery

Harvesting is by divers. Timing is critical as high roe content and quality are only found in late fall and winter. In Atlantic Canada, harvesting is generally in the late fall and winter or early spring prior to spawning. The principal market is in Japan.

There is no directed fishery for sea urchins in the study area. Based on DFO surveys of sea urchin feeding fronts conducted from 1995-1999, the Cape Breton sea urchin resource is under exploited. Some urchins are harvested as a by-catch in the lobster and scallop fisheries.

Short-finned Squid (*Illex illecebrosus*)

Information is from DFO fact sheets, Canadian Stock Assessment Secretariat Research Documents 97/60 and NAFO SCR Documents 99/49 and 99/50.

Distribution and Biology

The northern short-finned squid ranges from central Florida to Greenland with fishable concentrations found from the Gulf of St. Lawrence to Cape Hatteras. They travel in schools, often of one sex. Their abundance and distribution varies seasonally and annually. From April to June, young squid migrate from the Slope Water on to the offshore banks and mid-Atlantic Bight shelf area. From July to September, their distribution covers large areas of the Continental Shelf and some years they enter the Gulf of St. Lawrence. In October and November, mature squid migrate off the shelf. Squid have been recorded north of Prince Edward Island and in the Baie Verte area of Nova Scotia, however, no details specify whether this species was found as a commercial by-catch or in a scientific survey.

Squid do not spawn in the Gulf of St. Lawrence. Adult squid consume a variety of crustacea and fish.

The Fishery

The southern Gulf of St. Lawrence is not recognized by stock assessment scientists as a significant commercial fishing area. Bottom trawl surveys in the southern Gulf of St. Lawrence in September 1998 showed low abundance and biomass.

47°
46°
64°
63°
62°
61°
Tignish
Richibucto
Mount Pleasant
Bouctouche
SUMMERSIDE
Souris
CHARLOTTETOWN
Shediac
Montague
Bayfield
MONCTON
Port Elgin
AMHERST
Tatamagouche
Pictou Island
Pictou
NEW GLASGOW
Cape George
ANTIGONISH
PORT HAWKESBURY
Pleasant Bay
Cheticamp
Grand Etang
Margaree Harbour
Inverness
Port Hood
N
W
E
S

License Areas
Corridor EL 2368
Amoco SDL-082

Transportation
Roads
Rail
Ferry

Contours
305 Meters
152 Meters
50m
100m
150m

Sea Urchin (By-catch)
Squid (By-catch)

0 50 100
Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Commercial Fishery By-Catch
Sea urchin & Squid

Data Source: Gulf of St.Lawrence Traditional Knowledge Mapping Series, Department of Fisheries and Oceans (DFO) (J. Lee MacNeil & Associates, 1998)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

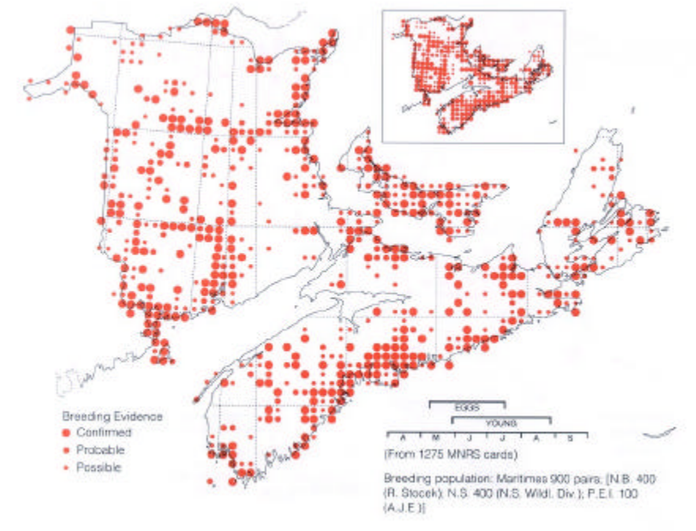
Osprey and Bald Eagle

Osprey (*Pandion haliaetus*) and Bald Eagle (*Haliaeetus leucocephalus*) both capture fish in shallow near shore waters. Osprey are almost entirely piscivorous while Bald Eagles feed on both fish and carrion. Osprey are present in the study area from April to October. Bald Eagles in the Maritime Provinces spend the entire year in the region. However, their distribution changes seasonally. During the spring, summer and fall they are found near their breeding sites which are typically located near coastal areas or rivers. During the winter months as open water becomes less available Bald Eagles will shift their distributions to areas having open water or abundant food sources. Many Bald Eagles from Cape Breton move to locations in mainland Nova Scotia such as the Shubenacadie River and the Annapolis Valley. Most leave the ice covered coastal areas during the winter. However, some Bald Eagles remain at sites where there is open water. One such site is at Pictou Harbour where Bald Eagles feed on carrion and waterfowl attracted to the thermal effluent from the Trenton power plant.

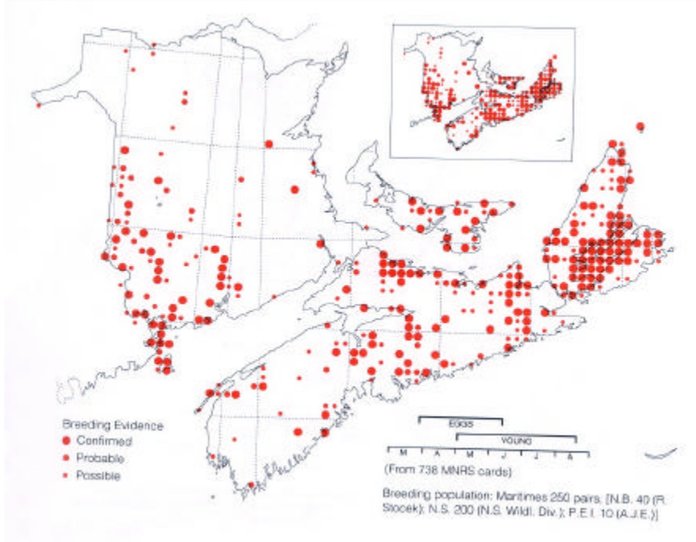
Raptors are protected under provincial law; consequently, raptor distribution data are compiled by individual provinces and not the federal government. Nest site data have been collected by the Nova Scotia Department of Natural Resources, New Brunswick Department of Natural Resources and Energy, and Prince Edward Island Department of Fisheries, Aquaculture and Environment, Fish and Wildlife Division. New Brunswick and Nova Scotia will not provide precise nest locations. Rather than collecting relatively imprecise data from six different sources (Osprey and Bald Eagle data in Nova Scotia are collected and stored by the regional biologists) information for these species was derived from the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992) which covers all three provinces. The distribution data in the atlas are presented in 10 km X 10 km atlas squares which is sufficiently precise to reveal regional distribution patterns for these species.

Ospreys in the southern Gulf are most abundant in the vicinity of estuaries and shallow bays and least abundant in areas having exposed coastlines such as western Cape Breton. Osprey are widely distributed throughout most of Prince Edward Island with the exception of the western end of the island which has few bays. In Nova Scotia, the distribution of Osprey is rather patchy; they are found at Antigonish Harbour, Merigomish Harbour, Pictou Harbour, the area from River John to River Philip and Baie Verte. In New Brunswick, Osprey are most abundant in the vicinities of Cape Jourimain, Buctouche, Richibucto, and Kouchibouguac National Park.

The general distribution of Bald Eagles is similar to that of Osprey in that the nesting areas tend to be near shallow bays and estuaries. There are some exceptions to this pattern such as the high concentrations of breeding Bald Eagles in western Cape Breton in the vicinity of Mabou Harbour. These birds probably feed in Mabou Harbour, Lake Ainslie and Patrick's Channel. The highest densities of breeding Bald Eagles in eastern North America are found around the shores of the Bras D'Or Lake. Elsewhere in Nova Scotia high densities of Bald Eagles are found around George Bay, Pictou Harbour and the area from River John to River Philip. On Prince Edward Island, Bald Eagles are largely restricted to the eastern half of the island. Bald Eagle densities in the New Brunswick portion of the study area are low.



Osprey Maritime Breeding Areas (from Erskine 1992)

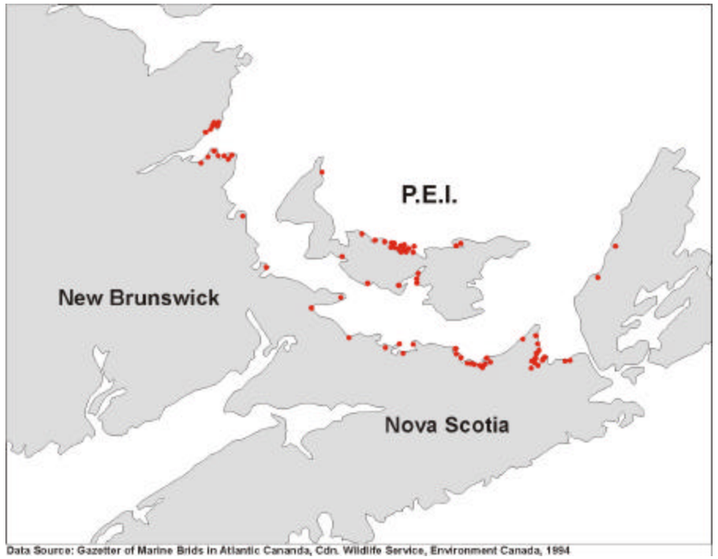


Bald Eagle Maritime Breeding Areas (from Erskine 1992)

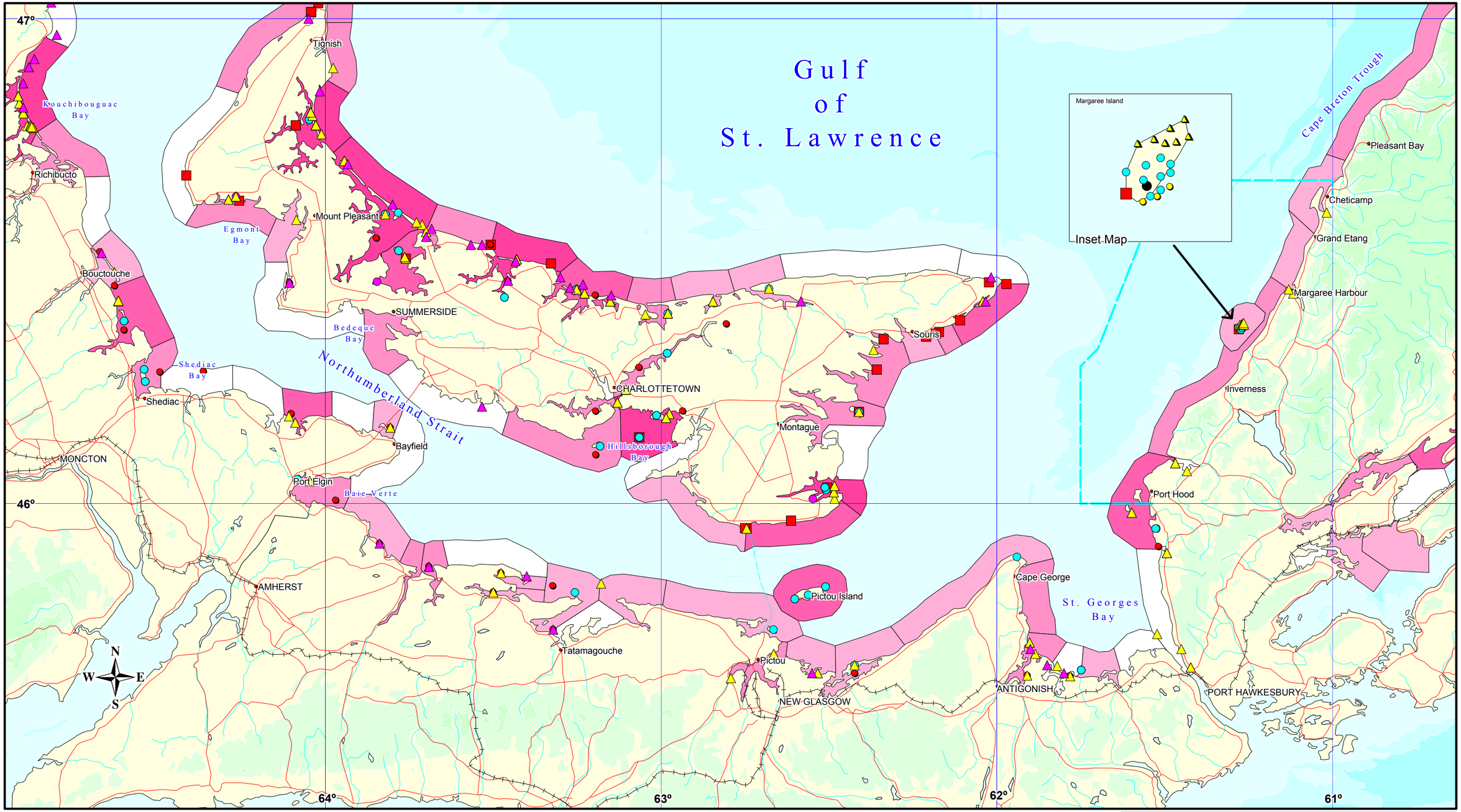
Shorebird Staging Areas

Approximately 30 species of shorebird congregate in the study area during the spring and fall migration. Shorebirds are most abundant during the fall migration which begins in July and ends in November. Peak numbers are typically encountered from late July to September. Shorebirds are less abundant during spring migration since many species move north along an inland migration route. Shorebird migrants found in the study area in descending order of abundance are Semipalmated Sandpiper (*Calidris pusilla*), Semipalmated Plover (*Charadrius semipalmatus*), Sanderling (*Calidris alba*), Short-billed Dowitcher (*Limnodromus griseus*), Black-bellied Plover (*Pluvialis squatarola*), Least Sandpiper (*Calidris minutilla*), Greater Yellowlegs (*Tringa melanoleuca*), Dunlin (*Calidris alpina*), and Red Knot (*Calidris canutus*). The highest concentrations of shorebirds are found in sheltered bays and estuaries. In Nova Scotia, areas supporting high numbers of migrating shorebirds are most concentrated around Antigonish, Pomquet, Merigomish and Pictou Harbours and around Tatamagouche. Only a few shorebird stop-over sites are present in western Cape Breton, but large numbers of birds frequent these sites. In Prince Edward Island, large numbers of shorebirds are found in coastal areas in the central portion of the province. In New Brunswick shorebirds are most numerous near Richibucto and Kouchibouquac National Park. .

The Gulf of St. Lawrence is second only to the Bay of Fundy in its importance as a stop-over site for migrating shorebirds. Migrating shorebirds are particularly susceptible to disturbance, habitat loss or degradation in their traditional migratory staging areas since large numbers of birds are often concentrated in a few locations. Shorebirds visit these locations because they are rich in food and are critical to the migrants' survival since they must quickly replenish fat reserves.



Shorebird Staging Areas Within the Southern Gulf of St. Lawrence



License Areas

Corridor EL 2368

Amoco SDL-082

Transportation

Roads

Rail

Ferry

Contours

305 Meters

152 Meters

50m

100m

150m

0 50 100

Kilometres

Bird Survey Areas - Number of Colonies

4 to 16

3 to 4

2 to 3

1 to 2

0 to 1

Plovers

Terns

Cormorants

Razorbill

Willet

Ring-Billed Gull

Great Blue Heron

Black Guillemot

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Distribution of Rare or Sensitive Marine Bird Breeding Sites

Data Source: Atlantic Canada Conservation Data Centre, 2000

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Coastal Waterfowl

The shallow coastal waters of the study area provide habitat for a variety of waterfowl. Northumberland Strait is an important migration route for a variety of seaducks including White-winged Scoter (*Melanitta fusca*), Surf Scoter (*Melanitta perspicillata*), Black Scoter (*Melanitta nigra*), Long-tailed Duck (*Clangula hyamalis*), and Common Eider (*Somateria mollissima*). With the development of mussel culture sites on the north shore of Prince Edward Island, this area has attracted large numbers of seaducks, which feed on the mussels. Large numbers of seaducks migrate through the area during both spring and fall, although the largest numbers are present in the fall. Fall migration typically begins in early September and ends in late November with peak movement occurring in late October (MacKinnon *et al*. 1991). Spring migration is less well defined and is heavily influenced by weather conditions which may temporarily halt the northward movement of birds. Spring migration usually begins in late March and is finished by mid-May with peak movement occurring in mid to late April.

Sheltered bays, estuaries, and salt marshes provide important breeding and feeding areas for other waterfowl such as American Black Duck (*Anas rubripes*), Green-winged Teal (*Anas crecca*), Greater Scaup (*Aythya marila*), Canada Goose (*Branta canadensis*), Red-breasted Merganser (*Mergus serrator*), and Common Goldeneye (*Bucephala clangula*).

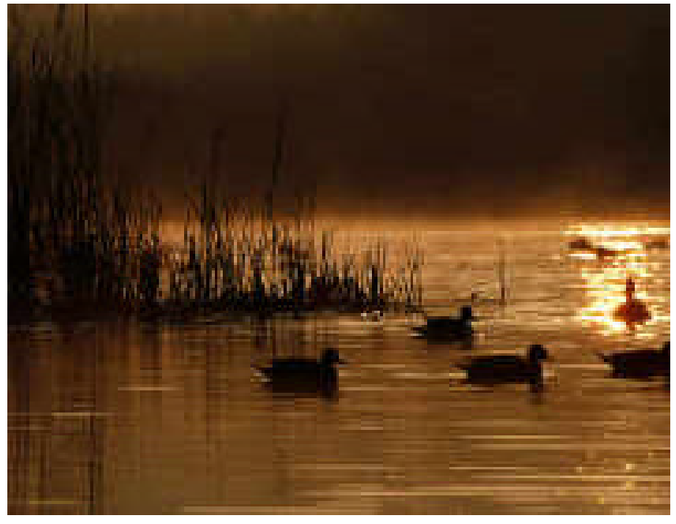
The maps of spatial and temporal distribution of coastal waterfowl are derived from Lock et al. (1994). From January to March the study area is largely ice-covered. At this time waterfowl which have not migrated south are concentrated in estuaries where flowing water maintains open water. Such areas include the Hillsborough and Murray Rivers in Prince Edward Island.

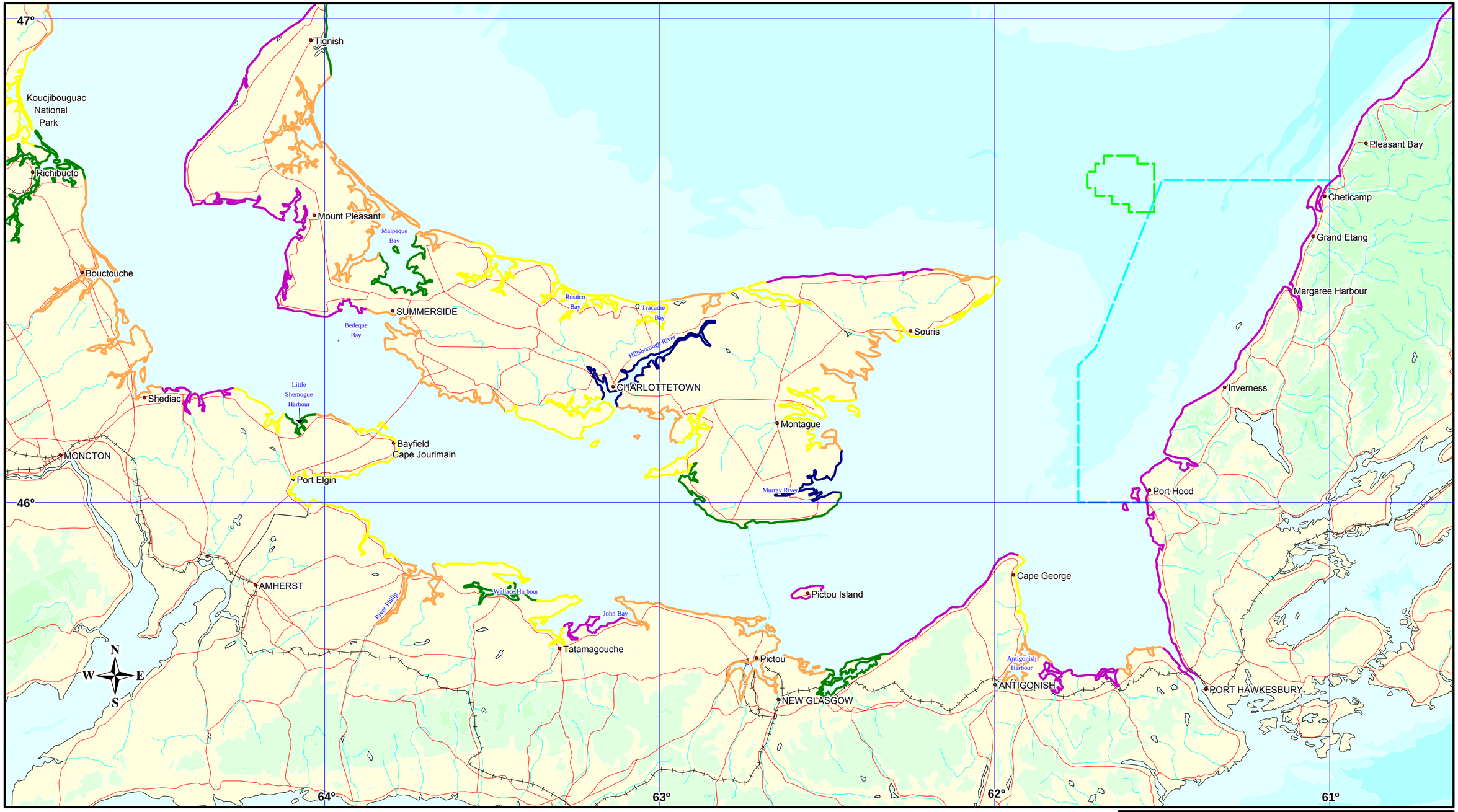
Large numbers of waterfowl move through the area in late March to early May. They are most abundant in shallow bays and estuaries with relatively few birds present along exposed shores. The highest concentrations are found near Kouchibouguac National Park, the Cape Jourimain National Wildlife Area and various locations in Prince Edward Island including the Hillsborough River, Malpeque Bay, and the shore of Northumberland Strait from Bedeque Bay to Brocklesby Head.

During May, waterfowl numbers decrease as spring migrants disperse to their breeding sites and remain relatively low from May until late August. Numbers begin to increase in September as adults and newly fledged young begin to migrate south. Areas which support the largest concentrations of waterfowl during the summer months include Antigonish Harbour and the area from John Bay west to Wallace Harbour, Nova Scotia, and Hillsborough Bay in PEI. In New Brunswick large numbers of waterfowl are found at the Cape Jourimain National Wildlife Area and in Little Shemogue Harbour.

Peak numbers of dabbling ducks such as American Black Duck and Green-winged Teal occur in late September. Seaduck numbers peak in late October. Waterfowl abundance then declines and by the end of November relatively few birds are present.

In Autumn the largest concentrations of waterfowl are found from John Bay west to Wallace Harbour and from River Philip west to Baie Verte. In New Brunswick waterfowl are most abundant from Baie Verte to Cape Jourimain. In PEI waterfowl are most numerous in Hillsborough, Bedeque, Malpeque, Rustico, and Tracadie Bays.





License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters

- 50m
- 100m
- 150m

Waterfowl / Km
- 0.01 to 0.24
- 0.25 to 2.49
- 2.50 to 9.99
- 10.00 to 1113.14
- Unsurveyed

0 50 100

Kilometres

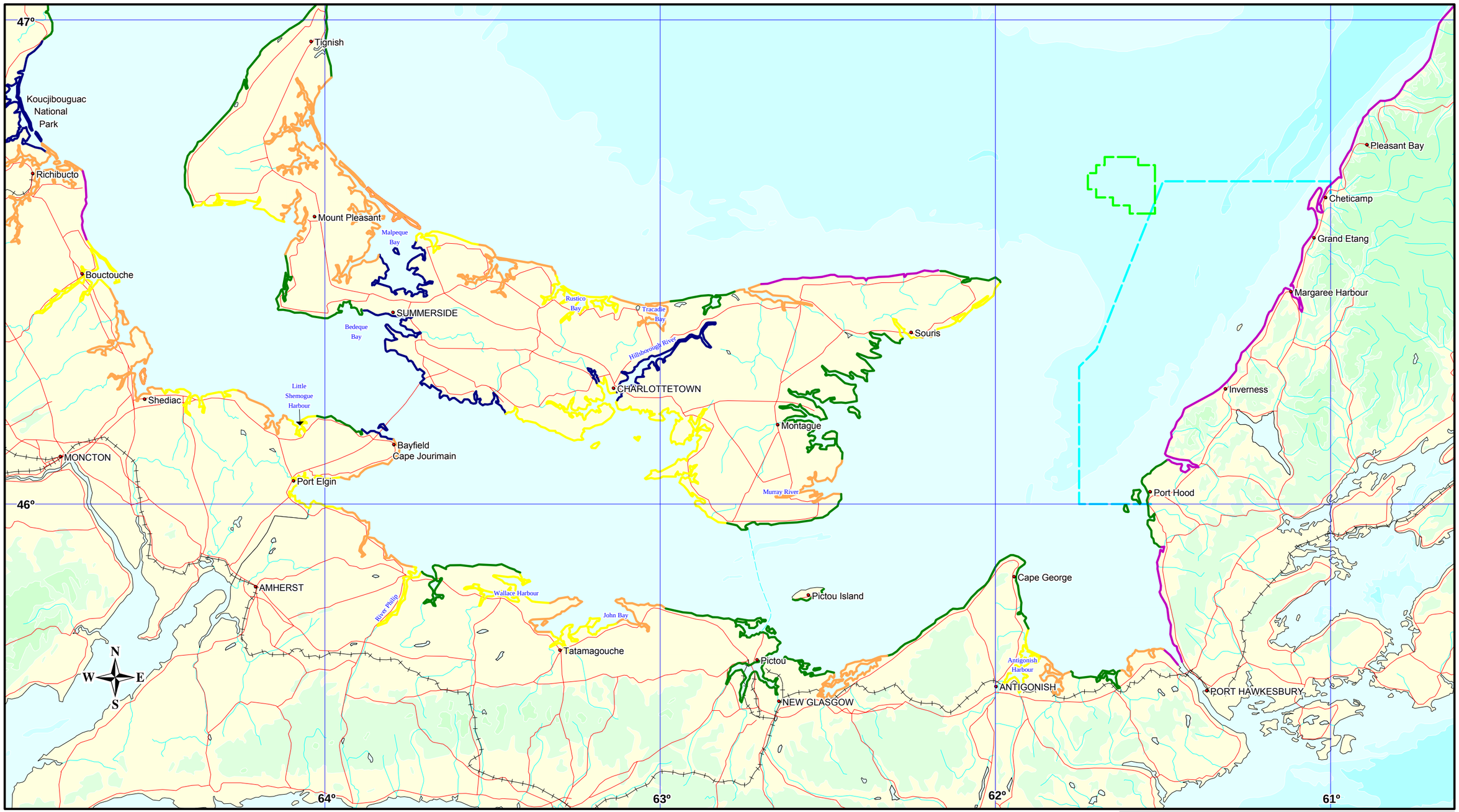
Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Waterfowl Distribution in the Gulf of St. Lawrence (January to March)

Data Source: Gazeteer of Marine Birds in Atlantic Canada, Lock et al 1994

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters

- 50m
- 100m
- 150m

Waterfowl / Km
- 2.50 to 7.49
- 0.03 to 2.49
- 7.50 to 22.49
- Unsurveyed
- 22.5 to 687.64

0 50 100

Kilometres

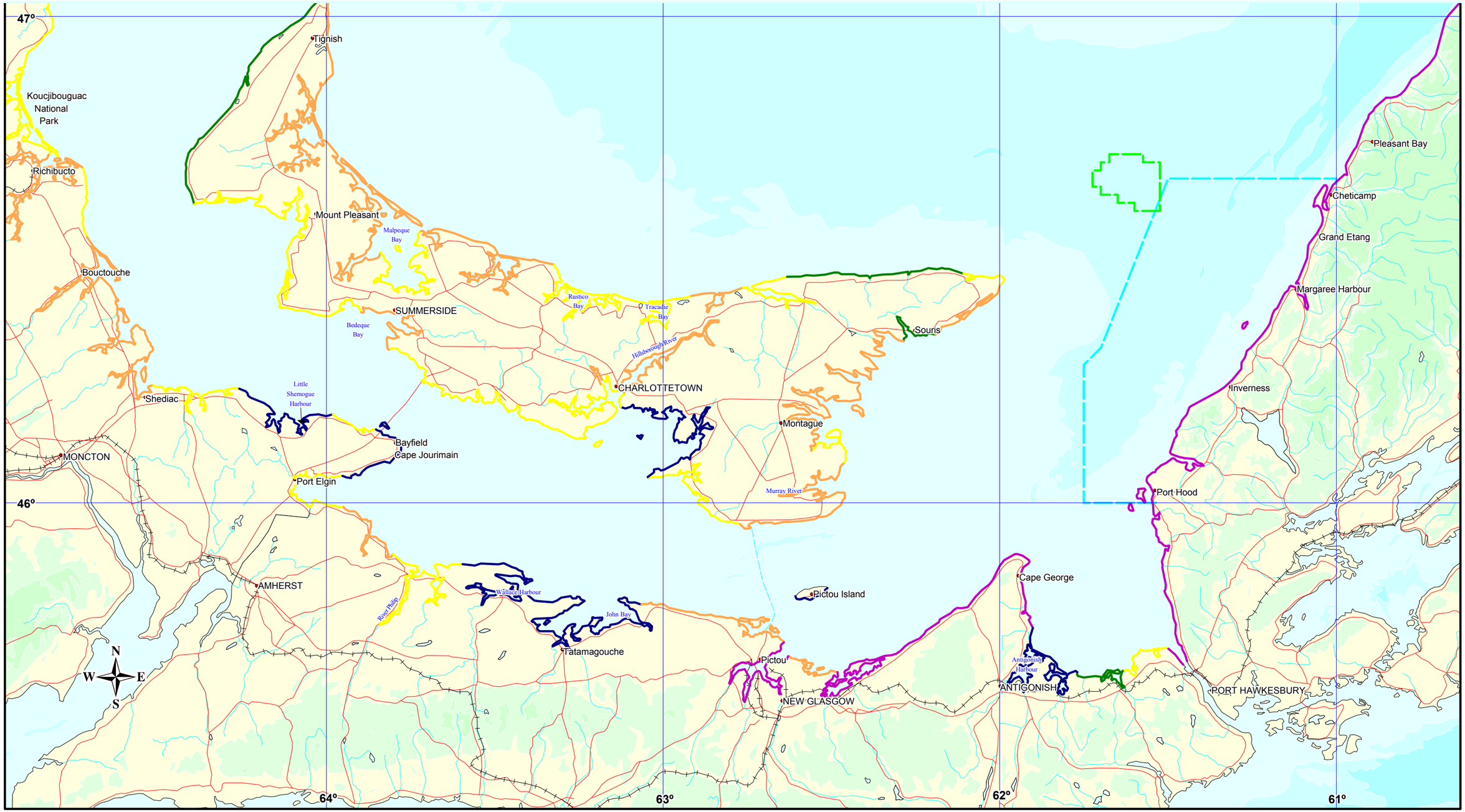
Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Waterfowl Distribution in the Gulf of St. Lawrence (April to June)

Data Source: Gazeteer of Marine Birds in Atlantic Canada, Lock et al 1994

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000



Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Waterfowl Distribution in the Gulf of St. Lawrence (July to September)

Data Source: Gazeteer of Marine Birds in Atlantic Canada, Lock et al 1994

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

47°
46°
64°
63°
62°
61°
Koucjibouguac National Park
Richibucto
Bouctouche
Shediac
MONCTON
AMHERST
Tignish
Mount Pleasant
Malpeque Bay
SUMMERSIDE
Bedeque Bay
Little Shemogue Harbour
Bayfield
Cape Jourimain
Port Elgin
Wallace Harbour
River Philip
John Bay
Tatamagouche
Rustico Bay
Tracadie Bay
Hillsborough River
CHARLOTTETOWN
Souris
Montague
Murray River
Pictou Island
Pictou
NEW GLASGOW
Cape George
Antigonish Harbour
ANTIGONISH
PORT HAWKESBURY
Pleasant Bay
Cheticamp
Grand Etang
Margaree Harbour
Inverness
Port Hood
N
W
E
S

License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

Waterfowl / Km
- 0.01 to 3.49
- 3.50 to 6.99
- 7.00 to 13.99
- 14.00 to 214.02
- Unsurveyed

0 50 100
Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Waterfowl Distribution in the Gulf of St. Lawrence (October to December)

Data Source: Gazeteer of Marine Birds in Atlantic Canada, Lock et al 1994

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Seals

Three species of seals frequent the study area: grey, harbour and hooded seals. Recently, harp seal pups are appearing on the shores of PEI and New Brunswick.

Grey Seals

Grey seals (*Halichoerus grypus*) are found within the Gulf of St. Lawrence year round. Males are larger than the females measuring up to 2.3 m long and weighing 300-350 kg. Females measure up to 2.0 m long and weigh 150-200 kg. Male grey seals are characterized by a long, arched, horse-like or "Roman" nose, heavy shoulders and thick folded skin in the neck area. The female's nose is smaller and narrower. The coat of mature males is dark brown, grey or black with lighter blotches on the neck and flanks. The female is lighter in colour, with dark spots on a grey, tan or yellowish background. In the water, grey seals tend to be solitary, but are gregarious and can be found hauled out with harbour seals in areas where the two species coexist.

Breeding occurs from mid-December to late February in the St. George's Bay area. Pups weigh 11-10 kg at birth and are weaned at about three weeks. Mating occurs after this time. The seals then disperse to areas along the Scotian Shelf, southern coast of Newfoundland, and Gulf of St. Lawrence. Northwest Atlantic population estimates from 1997 show numbers reaching approximately 190,000 grey seals (Maurice Lamontagne Institute 1999).

Grey seals feed upon herring, flounder, cod, skate, squid, mackerel, shrimp, rock crab and algae. Grey seals are considered a competitive threat to commercial fishing both for the resources and as a culprit for damage to fishing gear.

Harbour Seals

Harbour seals (*Phoca vitulina concolor*) are the least abundant of the three species of seal species found in the southern Gulf. The colour and pattern of the harbour seal coat can vary. Most conspicuous are the spots, rings and blotches, more numerous on the back than the belly. Males range from 1.4-1.9 m long and weigh 70-130 kg; females are slightly smaller. Harbour seals are often found alone or in small groups at sea, but are gregarious at haul-out sites.

They breed in aggregations around Prince Edward Island, the western shore of Cape Breton, between Miramichi Bay and Baie des Chaleurs. Female harbour seals mature between three and four years of age and males between five and six years. They give birth to a single pup during May and June. Females suckle their young for one month. Mating takes place after the pup is weaned.

In the 1970s, the Eastern Canada harbour seal population was estimated at 12,700 individuals. Harbour seals are piscivorous and feed upon herring, flatfish, gadoids, silver hake, alewife, smelt, mackerel, capelin and squid (Maurice Lamontagne Institute 1999).

Hooded Seals

Hooded seals (*Cystophora cristata*) live over the deep waters of the North Atlantic Ocean, in particular associated with the outer edge of pack ice during much of the year. These seals are wide ranging solitary animals except in breeding and molting seasons, so their distribution in the fall and winter is poorly known. The entire breeding season spans two to two and a half weeks through March and early April. In the Gulf, this area includes the Magdalen Islands. Females give birth to one pup on pack ice. Pups are weaned in four days. After this period, most hooded seals migrate to the Greenland coast.

Hooded seals males are larger than the females and also have a black, crescent shaped, inflatable nasal sac that when flacid droops down over the muzzle. Inflation of the red balloon-like nasal sac is used in courtship and dominance displays.

Hooded seals fed on a variety of fishes and invertebrates including Greenland halibut, redfish, polar cod and squid.

Gulf of St. Lawrence

Kouchibouguac Bay
Egmont Bay
Shediac Bay
Bedeque Bay
Northumberland Strait
Hillsborough Bay
Baie Verte
Cape Breton Trough
St. Georges Bay

Tignish
Richibucto
Mount Pleasant
Bouctouche
SUMMERSIDE
Souris
CHARLOTTETOWN
Shediac
Montague
Bayfield
MONCTON
Port Elgin
AMHERST
Pictou Island
Tatamagouche
Pictou
NEW GLASGOW
Cape George
ANTIGONISH
Pleasant Bay
Cheticamp
Grand Etang
Margaree Harbour
Inverness
Port Hood
PORT HAWKESBURY

47°
46°
64°
63°
62°
61°

N
W
E
S

License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

- GreySeal Whelp
- Harbour Seal
- Hooded Seal Whelp

0 50 100
Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Seasonal Distribution of Seals

Data Source: Department of Fisheries and Oceans, Canadian Wildlife Service

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Whales

Whales are divided into two distinct groups: baleen and toothed whales. Five species of baleen whales and eight species of toothed whales occur in the southern Gulf of St. Lawrence.

Whale Species Occurring in the Gulf of St. Lawrence

Whale Species	Scientific Name	Habitat/Distribution
Baleen Whale Species		
Fin Whales	*Balaenoptera physalus*	offshore Scotian Shelf, the Gulf inshore seasonally
Humpback Whales	*Megaptera novaeangliae*	Bay of Fundy, Newfoundland, offshore
Minke Whales	*Balaenoptera acuterostrata*	Scotian Shelf Break, the Gulf, coastal
Northern Right Whales	*Eubalaena glacialis*	Gulf of Maine, Bay of Fundy, Scotian Shelf
Blue Whales	*Balaenoptera musculus*	offshore, Newfoundland, Gulf of St. Lawrence
Toothed Whales Species		
Long-Finned Pilot Whale	*Globicephala melas*	offshore, inshore summer
Bottlenose Dolphin	*Tursiops truncatus*	Scotian Shelf
Striped Dolphin	*Stenella coeruleoalba*	Scotian Shelf
Common Dolphin	*Delphinus delphis*	Scotian Shelf and edge
Killer Whale	*Orcinus orca*	Arctic, Subarctic, Tropics
White-beaked Dolphin	*Lagenorhynchus albinostris*	offshore, NW Atlantic Ocean
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	offshore, inshore summer
Harbour Porpoise	*Phocoena phocoena*	Subarctic, Gulf and Scotian Shelf, inshore

Refs: Gaskin 1992, Kingsley and Reeves 1998, Mercer 1973, Nelson and Lein 1996, Palka et al. 1997, Palka et al. 1996, Reeves and Mitchell 1988, Sear and Williamson 1982, Sergeant 1961, 1982, Sergeant and Fisher 1957, Sergeant et al. 1970.

Kingsley and Reeves (1998) state that "little quantitative information has been available on the Gulf's cetacean fauna, in particular, the abundance and distribution of odontocetes (toothed whales and dolphins, including pilot whales) have been poorly known, except for the intensively studied population of belugas in the St. Lawrence River."

Finback, minke and blue whales are the most common baleen whales to the Gulf of St. Lawrence; humpback whales are less common. Historically, right whales were sighted in the Gulf but not in recent years; their distribution is typically in the Gulf of Maine and Bay of Fundy. Of the toothed whales, killer and right whales are less common compared with pilot whale, white-sided and white-beaked dolphins, and harbour porpoise. Except for belugas in the Estuary, population estimates are not available for toothed whales in the Gulf or Estuary. There are relatively large numbers of dolphins, moderate numbers of porpoise and a smaller number of pilot and killer whales. Population status on baleen whales in the Gulf is dated (late 1970s and 1980s). Finback and blue whales number in the order of 300 and 200, respectively. Humpback numbers range between 150-200 animals. According to COSEWIC, blue, fin and humpback whales are considered vulnerable species. This category refers to species at high risk due to low or falling numbers, occurrence at the limit of range or restricted areas, or for other reasons.

The most comprehensive studies of cetacean distribution in the Gulf of St. Lawrence have been based on aerial surveys. Kingsley and Reeves (1998) estimated abundance from aerial transects of the entire Gulf of St. Lawrence in late August and early September of 1995 and in the northern shelf area of the Gulf in late July and early August of 1996. While this information likely represents the best available, it is limited to a very short season, and in the southern Gulf, can provide no estimate of variability of abundance. An estimate of variability is extremely important as differences can be striking even between years, as shown by Kingsley's and Reeve's (1998) estimates of harbour porpoise abundance (12,000 in 1995 and 21,000 in 1996, despite the reduced sampling effort in 1996). Other aerial surveys are reported by Sears and Williamson (1982). Their five surveys between January and November 1982 sighted only pilot whales along the western coast of Cape Breton. Unfortunately, this sampling method did not reveal the extensive species diversity which is clear when historical stranding records are consulted. These strandings reports (Sergeant et al. 1970, Sergeant 1982) are at times combined with anecdotal accounts of sightings (Sergeant and Fisher 1957). Yet both are inappropriate sources from which to deduce the abundance and distribution, let alone movements and habitat use of the cetaceans which inhabit the southern Gulf of St. Lawrence.

There is no concerted effort to record live cetacean sightings on these surveys. Hence, the systematic, published data which are available on cetacean occurrence in the southern Gulf of St. Lawrence are limited and provide only preliminary estimates of species abundance.

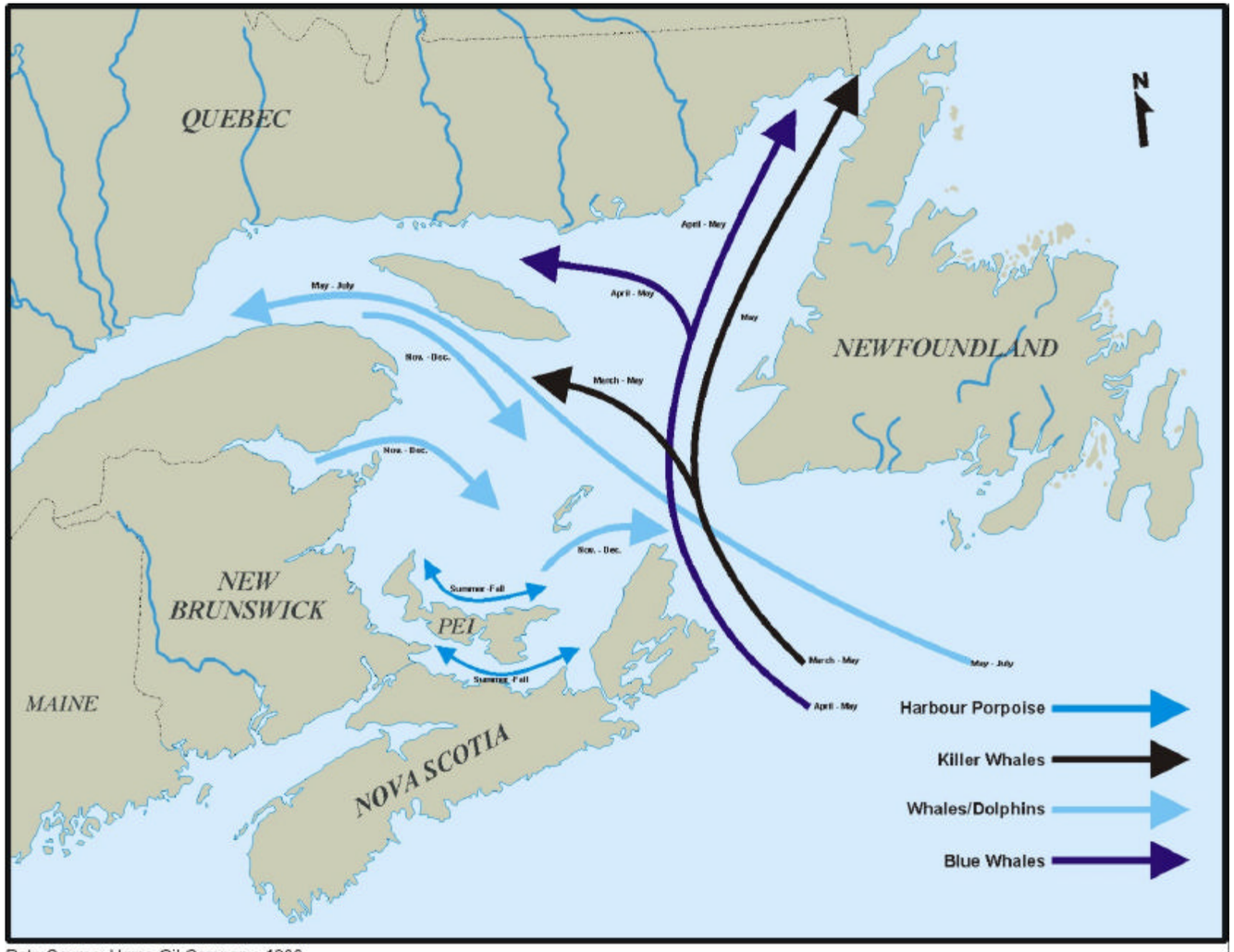
Local knowledge

The west coast of Cape Breton Island supports a substantial whale watching industry. Given the comments above individuals involved in these industries may indeed have the best understanding of cetaceans present in that area. These individuals confirm 1) that there are frequent sightings of many of the cetacean species listed above, 2) that while some species are present at a relatively predictably, this is not true for all species, and 3) that there are cetaceans sighted outside the summer season, indeed at any time when ice is not present. Local observations also suggest that the west coast of Cape Breton is a feeding and calving ground for at least some cetacean species. Sightings are most predominant in the area adjacent to Polletts Cove. Whales have been seen feeding, by local operators in the area adjacent to Pleasant Bay. The majority of minke, finback, and pilot whale sightings occur from June to August and humpback whales are observed predominantly in August and September (Mark Timmons, pers. comm.).

There is considerable whale migration through the Gulf because of winter ice. In the spring (after March) toothed and baleen whales migrate into the Gulf. Blue and humpback whales leave by early fall, followed by minke, finback and toothed whales in November-December. Blue and humpback whales are predominantly found

along the north shore. All baleen whales breed outside of the region. In the summer, pilot whales, white-sided dolphins and harbour porpoises birth in the Gulf.

The diet of baleen whales consists of crustaceans, such as krill, and benthic and pelagic fish capelin, squid, herring, pollock, mackerel, sand lance. In general, toothed whales consume fish (herring, silver hake, smelt, capelin, mackerel, pollock), shellfish and squid; however, killer whales pursue other marine mammals as well.



Data Source: Home Oil Company, 1980

Migration Route of Cetaceans in the Gulf of St. Lawrence

Tourism, Recreational Parks and Protected Areas

Summer in the southern Gulf, though short, is warm and sunny, and the shallow coastal waters warm rapidly and are good for swimming, sailing, canoeing and other water-based recreation. The low-lying coast provides miles of sand beaches and the area has been an attractive tourist destination for many years.

Beaches are an important ecosystem in the coastal zone as they provide habitat for many plant and animal species and protect fragile areas behind dunes from wind and water erosion. Beach parks are created to meet the needs for suitable bathing and swimming areas.

The coastline is characterized by many small, protected estuaries. The Antigonish estuary of Nova Scotia, and the Cardigan estuary of Prince Edward Island are large estuaries. Estuaries provide habitat for many animals and plants, a nursery and transition zone for fish, as well as staging and nesting areas for birds. Estuaries also have significant economic importance as areas of settlement and development. These ecosystems are subject to urban and industrial pollution.

Salt marshes are numerous throughout Atlantic Canada. In Prince Edward Island they are located on the Hillsborough River. In New Brunswick, salt marshes are found along most of the coast. Salt marshes are some of the most productive ecosystems along the coast. Salt marshes are an important nursery area for some fish, and are used by many other species for feeding and resting. Sixty-five percent of all the salt marshes in Atlantic Canada have been altered or destroyed for housing development, and road construction or diked for farming (Beardmore 1985).

New Brunswick

The northeastern shore of New Brunswick from Pointe-Sapin to Tidnish has large stretches of attractive beaches, provincial parks, an ecological area of international significance. Parlee Beach Provincial Park known for its' white sandy shores and the Shediac Lobster Festival.

Kouchibouguac National Park is used for hiking, camping, kayaking and bird-watching. The Irving Eco-Centre La Dune de Bouctouche is an ecological area home to rare plants, fragile marshes, and nesting grounds for terns and the endangered piping plover. Another important site is Cape Jourimain National Wildlife Area which is frequented by large numbers of migrant waterfowl and shorebirds. It also provides nesting and rearing habitat for waterfowl species (Beardmore 1985).

Nova Scotia

Northumberland Strait has the warmest summertime waters north of the Carolinas. There are over 35 sandy beaches, 29 parks including 24 provincial parks, with outdoor activities such as hiking trails, sand dunes and salt marshes. Two national wildlife areas are established in the Nova Scotia portion of the study area.

Wallace Bay National Wildlife Areas situated in Wallace Harbour on Northumberland Strait provides migration and production habitat for waterfowl. The nature trail is a popular spot for bird watching with nearly 200 different species identified. Margaree Island National Wildlife Area is a site of breeding colonies of several seabirds and human activities are limited.

A waterfowl game sanctuary situated at Brule Point provides a goose resting area. Wildlife Management Areas are present in Antigonish Harbour and Abercrobie.

Cape Breton Highlands National Park is the largest natural area in the study area and provides scenic views, camping , hiking, skiing, fishing, golf, etc.

Pictou is known as "The Birthplace of New Scotland", the original Scottish settlers arrived by ship to this area in 1773. Northumberland Ferries operate between Caribou and Wood Island on eastern Prince Edward Island through the summer. Boat tours designed specifically for whale watching and deep-sea fishing operate along the Gulf shore of mainland Nova Scotia and western Cape Breton. From mid-May to the end of November this area is busy with festivals and events, the largest being the Antigonish Highland Games. Many towns and villages have cultural museums and interpretive centers.

Prince Edward Island

There are 45 beaches on Prince Edward Island. Panmure Island, Cabot Park, Souris Beach, and PEI National Park are beach areas ideal for bird watching while others are more suitable as walking areas.

Black Pond Migratory Bird Sanctuary is situated near Souris and provides the most important waterfowl production and migration habitat in eastern PEI.

Cable Head and Sir Andrew MacPhail are designated natural environment parks which are lands set aside for educational purposes. Wildlife Management Areas are established at Rollo Bay, Orwell Cove and Indian River.

Many festivals and events some that run throughout the year and all attract people from around the world. Each summer Charlottetown is host to the Festival of Lights and Festival of the Fathers both of which are nationally renowned festivals celebrating the birthplace of Canada.

PEI is also quickly becoming a world-class golf destination. Deep sea fishing for tuna and sport fishing for brook trout, rainbow trout, and salmon are popular activities all across the island. Many tourists come to visit the inspiration behind the novels written by L.M. Montgomery at Green Gables in PEI National Park.

License Areas

- Corridor EL 2368
- Amoco SDL-082

Transportation

- Roads
- Rail
- Ferry

Contours

- 305 Meters
- 152 Meters

- 50m
- 100m
- 150m

- Small Craft Harbour
- Bird/Whale Watching
- Deep Sea Charter
- Golf Course
- Tuna Fishing Charter
- Whale Watching

0 50 100

Kilometres

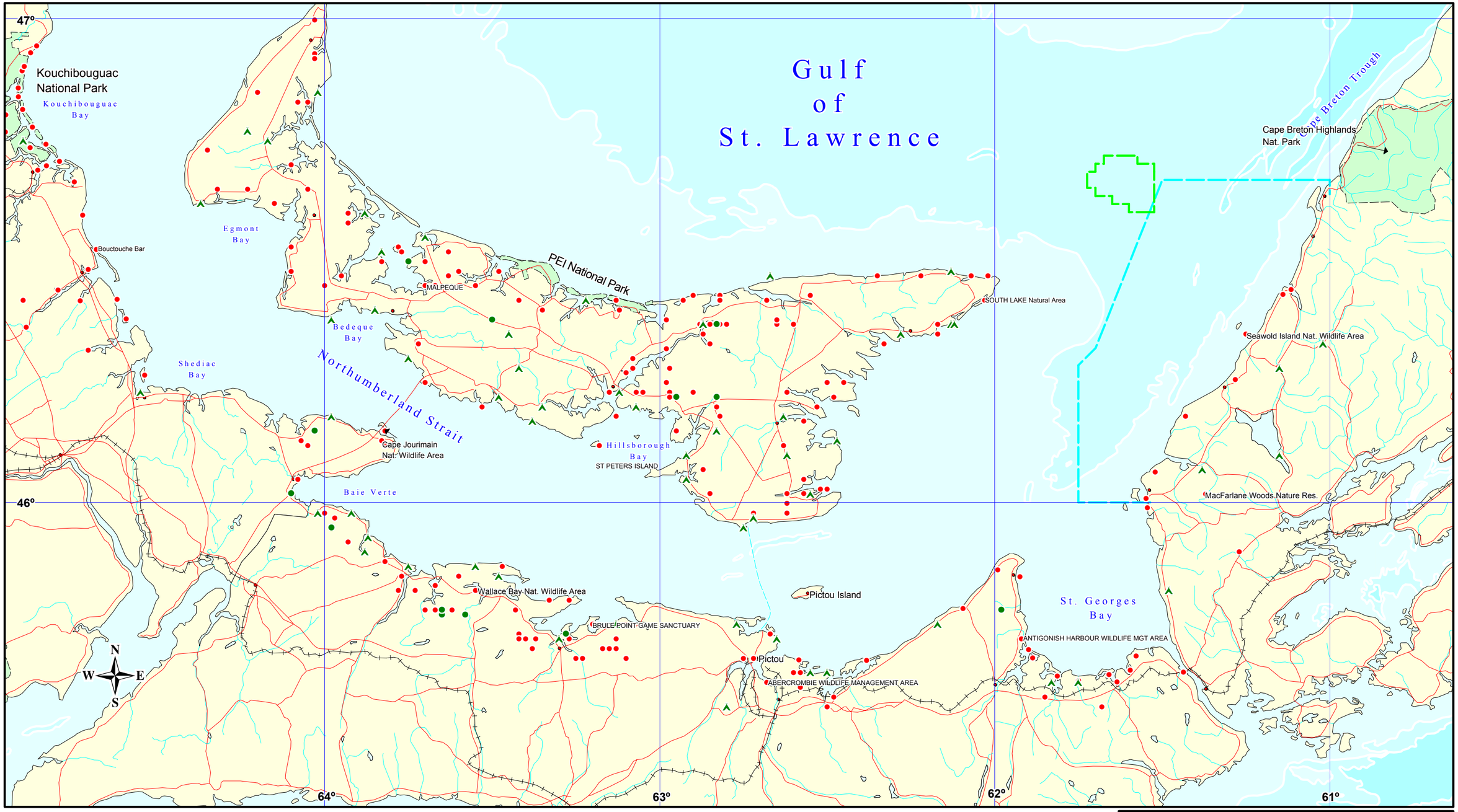
Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford
Environment Limited

Tourism & Eco-Tourism Sites

Data Source: Government of N.B.; N.S.; P.E.I. Departments of Tourism,
(Various Published Sources / Tourism Guides)

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000



License Areas

- Corridor EL 2368
- Amoco SDL-082
- National Park
- Protected Area
- Protected Marsh
- Park / Campground / Picnic

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

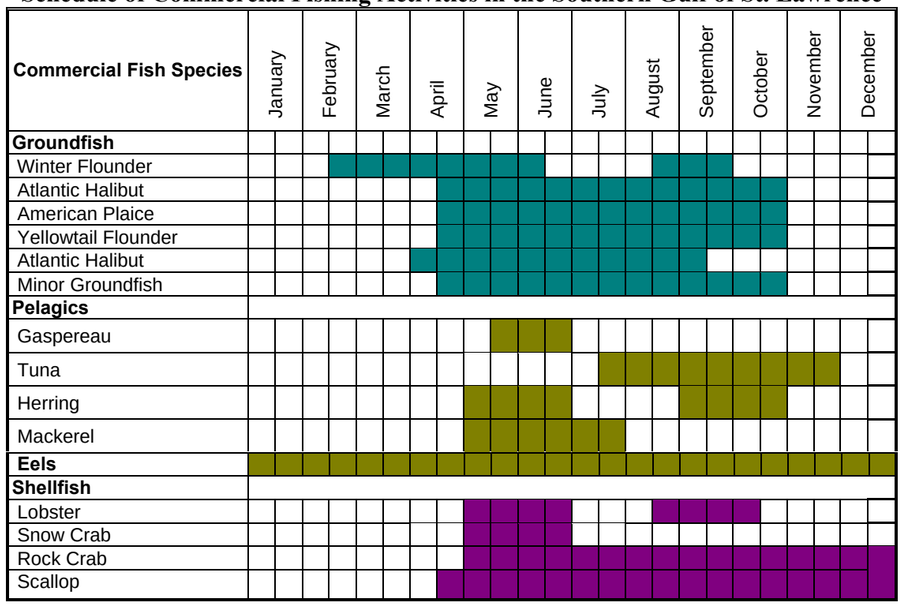
Environmentally Sensitive Areas, Parks, Marshes & Protected Areas

Data Source: Nova Scotia Department of Natural Resources
PEI Department of Tourism, NB Dept. of Natural Resources
National Landuse Database of Canada

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Seasonality and Seasonal Sensitivity of Commercially and Ecologically Important Resources in the Southern Gulf of St. Lawrence

Schedule of Commercial Fishing Activities in the Southern Gulf of St. Lawrence

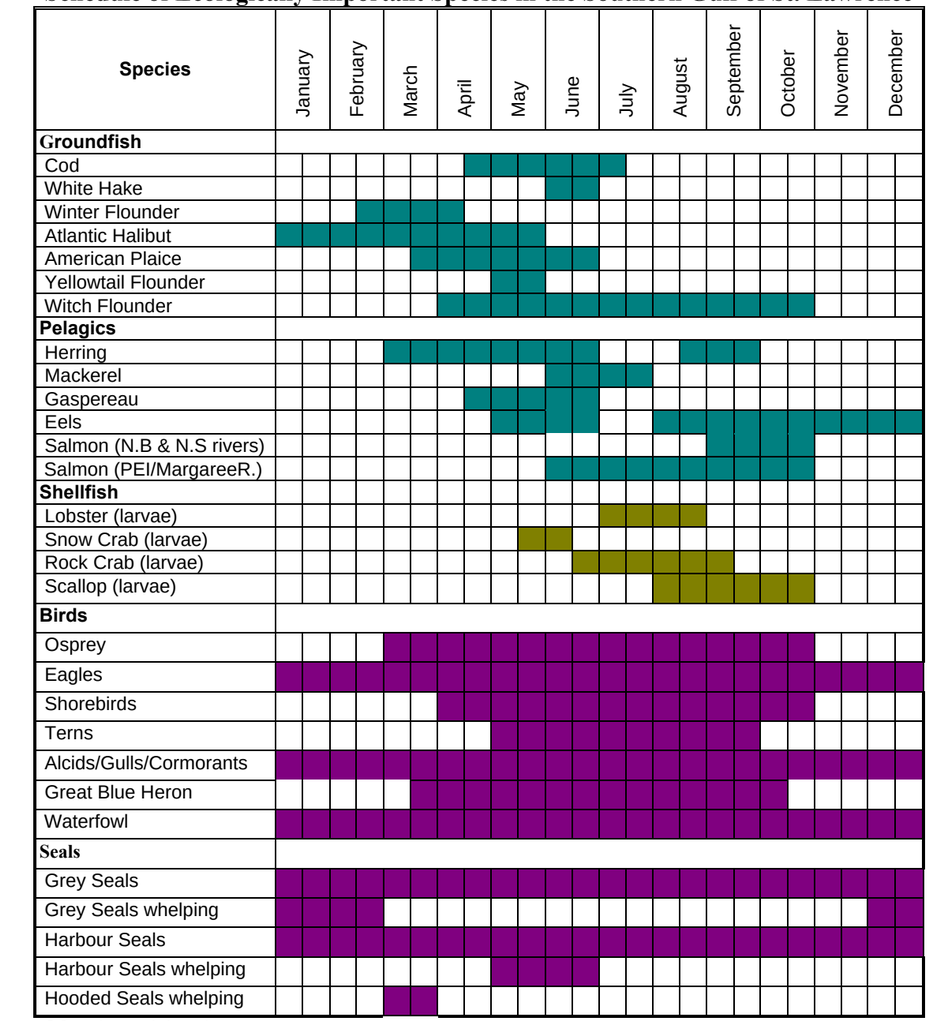


Commercial Fisheries and Fish

There is no available statistical information on First Nations fishing activity in the southern Gulf of St. Lawrence. The Marshall Decision states that Natives can fish commercially when and where they choose but this issue is volatile and remain undecided at this time. DFO is attempting to bring native fishers under the DFO management regime. Information in this section describes DFO management schedules.

The length of groundfish fishing seasons are determined by the time taken to fill quotas. Therefore, the end of the fishing season for a particular species varies from year to year. Overall, the fishing for groundfish generally commences in the spring (mid- April, or the earliest the area is ice-free) and continues to October. The spawning periods of the different species are species specific. Halibut spawn in winter and witch flounder into the fall. Most species spawn in the spring, March to May, which is coincident with the spring plankton bloom; an abundant food supply for the larvae and juveniles. The eggs are buoyant and hatch within a matter of days. Flatfishes have extensive pelagic larval stages before they settle to the seafloor. These periods can extend from 2-3 months for winter flounder, 6-7 months for halibut or up to a year for witch flounder. Cod eggs are buoyant and remain planktonic during incubation, 14-60 days, depending on temperature. The young remain planktonic until 25-50 mm long, perhaps on the order of several months, then descend to the bottom. White hake likely have a similar egg and larval period, but growth rates are not well known.

Schedule of Ecologically Important Species in the Southern Gulf of St. Lawrence



note: Whelping – giving birth to a seal pup

Fisheries for pelagic species occur throughout spring, summer and fall. Bluefin tuna are fished from July to November. The herring fishery coincides with the spring and fall spawning periods. Mackerel are fished from spring to summer, including during their spawning period from June to July.

The schedule for Atlantic salmon represents timing for entering southern Gulf rivers. The Morell River and Margaree Rivers have early runs of salmon, all other rivers in the study area have fall runs of salmon. The timing of acclimation in the estuary and seaward migration of adults is not well known for any of the rivers in the study area (P. LeBlanc, DFO, pers. comm.). Little research has been undertaken on salmon at sea. Eels and gaspereau are also fished during their migrations into rivers.

Invertebrate fisheries may be regulated by season and/or quota. Lobster seasons are either in spring after the ice leaves, or in late summer and fall. Snow crab seasons begin in spring. Scallop fishing seasons generally begin in spring or early summer but there are distinct differences among the different management areas.

The larvae of commercially important shellfish are present primarily in the summer months, June to early September. Snow crab have the earliest and briefest larval season from mid-May to mid-June. Scallop spawn in summer and larvae occur later in the season, from August to October. The larvae of crabs and lobster molt several times before taking the shape of the adult and settling to the seafloor. These changes take place of over several weeks. Larvae usually appear first in plankton nets in mid-June and last until mid-September. Larvae of different species occupy different layers of the water column. Planktonic larvae are near the surface in the top 70 cm or so. Other species are deeper, such as the scallop and are found near the bottom.

Birds

Piping Plovers arrive in the Maritime Provinces in early April and lay eggs in mid-May. Most Piping Plovers have left by mid-September. Semipalmated Plovers begin to arrive in late April. Most pass through the Maritime Provinces during migration, however, a few stay to breed. These birds lay eggs in early May. Fall migration begins in mid-July and ends in November with peak numbers occurring during the period July–mid-September.

Willets first arrive in late April. Those which breed in the Maritime begin nesting in May. Most leave the area in August with the last regular sightings occurring in early October.

Common Terns typically arrive in early May and Arctic Terns arrive in mid-May. Common Terns begin departing the Maritime Provinces in late August, with most gone by the end of September. Arctic Terns begin to leave in mid-July and most are gone by mid-September.

Great Cormorants arrive in the Maritimes in late March and begin to lay eggs in late April. Fall migration begins in September and reaches its peak in late October. A part of the local population is non-migratory and spends the winter near their breeding colonies. Double-crested Cormorants arrive at about the same time as the Great Cormorants; however, they tend to leave the area earlier. Fall migration typically begins in August, with most birds departing between mid-September and late October. This species begins laying eggs in late April or early May. A few Double-crested Cormorants winter in the Maritimes but the majority leave the area during the winter months.

Most Ring-billed Gulls arrive in the Maritimes in late April and early May and leave between September and early November although small numbers overwinter in areas where mudflats remain exposed or around sewer outfalls.

Great Blue Herons typically return to the Maritime Provinces in late March. Breeding begins in mid-April and the young are generally fledged by early August. Fall migration peaks during the period between late September and October.

Black Guillemots arrive at their breeding areas in mid-April. Egg laying begins in early June. This species resides in the Maritime Provinces year round.

Razorbills occur as both transients and breeding birds. Most birds observed are transients which breed outside of the Maritime Provinces and spend the fall and winter at sea. Transient birds are present mid-October to mid-May. Breeding birds are present at this time as well but remain in the vicinity of their nesting colonies during the late spring and summer. Nesting typically begins in late May or early June.

Osprey are present from March through to October. Eggs are laid in early May and the young are generally fledged by mid-August.

Bald Eagles are present year round. They lay their eggs in early April and the young are typically fledged by late July.

Large numbers of shorebirds pass through the area during the fall migration. Fall shorebird migration extends from July to November. Peak numbers of migrants are present between July and September.

Waterfowl are present in the study area year-round; however, there are seasonal fluctuations in abundance and distribution. Waterfowl are most abundant during spring and fall migration. Spring migration typically extends from March to May with peak numbers occurring in mid to late April. Fall migration extends from early September to late November with most birds passing through in late October. Waterfowl abundance

decreases in May as the last of the migrants move through leaving behind the breeding population. Waterfowl breed as early as April, extending to early August by which time when most young have fledged. Waterfowl begin to stage in late August and early September prior to fall migration. By December few remain. These birds tend to be concentrated in ice free areas which provide adequate winter food. They remain at these ice free areas until the ice begins to break up in March.

Seals

Grey seals and harbour seals are year round residents in the study area. Grey seals whelp their young on the ice from December through to February. Harbour seals whelp their pups on land in May and June. Hooded seals are only present in the study area during the brief whelping season on the ice in March.

Whales

Whale presence in the Gulf is dictated by ice. Migrations into the Gulf start in May as the ice recedes followed by migration out of the Gulf and into the Atlantic Ocean in November.

Archaeological and Historical Sites

New Brunswick

The location, number and kind of archaeological/heritage resources were determined through consultation with files held New Brunswick Archaeological Services, of the Dept. of Education (Culture and Sports Secretariat). This office maintains a database of all known provincial archaeological sites. The provincial site maps and the sites database were consulted, and the resulting information was further developed by consulting the Maritime Archaeological Resource Inventory (MARI) forms for each site.

The coastline in the New Brunswick portion of the study area (from the Richibucto Harbour to the Nova Scotia border) contains 79 recorded archaeological sites (9 of these were slightly to the north of Richibucto Harbour. This sample reflects only a portion of extant archaeological sites, and further survey and research will undoubtedly accrete more information. Of these sites, 54 can be attributed to the pre-contact period (before 500 years ago), 19 can be attributed to the post-contact period (the last 500 years), and three have both pre-contact and post-contact components. For an additional three sites, there was insufficient information in the site records to determine the broadest chronological information. The pre-contact period sites are by definition derived from Native North American activity, while the post-contact (historic) period sites may be the result of activity by people of Eurasian/African descent, but may also be the result of Native North American peoples.

Finds from the pre-contact period include surface collections, points, chipped stone (biface), shell middens, stone scrappers, stone axes and other stone implements and flakes. Items identified as post-contact include cellars, foundations, a fort, an Acadian dyke, artifacts of domestic activity, cemeteries, habitation sites and surface collections.

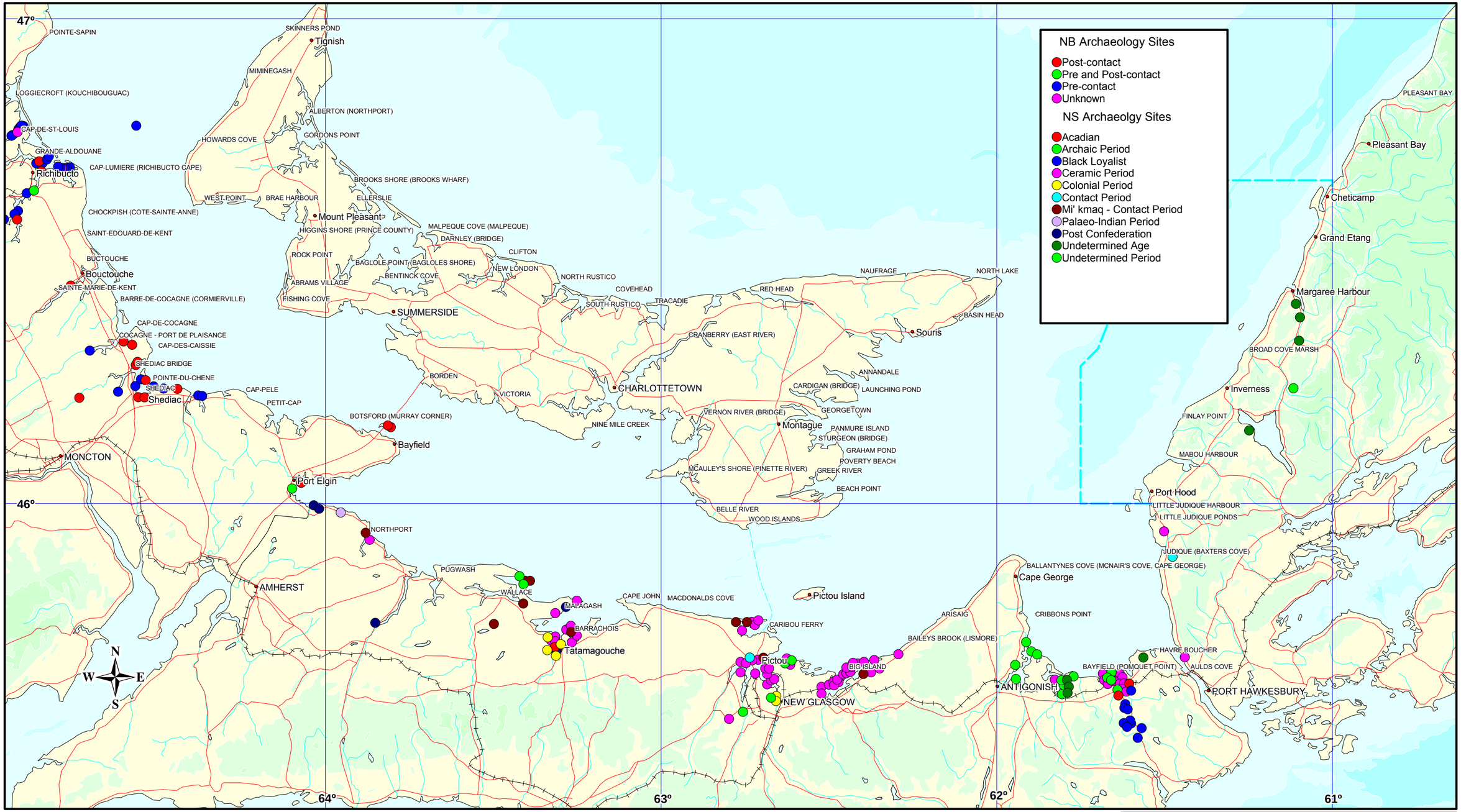
Nova Scotia

The data source that was used for the project was the Maritime Archaeological Resource Inventory. This inventory outlines all of the confirmed archaeological finds in Nova Scotia. It includes a description of the site, its general location and the nature of the finds at that location. This information is available to archaeologists and is located at the Nova Scotia Museum in Halifax. The Nova Scotia Museum's web site, www.museum.gov.ns.ca, was also used in reference to the age chronology of the sites and its reported finds.

The north shore of Nova Scotia and western Cape Breton contains 8 Palaeo-Indian, 63 Maritime Woodland and 20 undetermined sites from prehistoric times or the pre-contact period (before 500 years ago). In the post-contact period, there are 3 Contact, 10 Mi'kmaq, 6 Colonial, 3 Acadian, 5 Post Confederation, 10 Black Loyalist, and 3 unspecified time periods. The type of find at the pre-contact sites include gouges, lithic artifacts, a rhyolite point, a fluted point, celts, isolated finds, shell middens, general activity, adzes, knives, and bone tools. Items found from the post contact period include shell middens, structural and industrial features, general activity, bottles, burial deposits, a trade axe, a glass bead and isolated finds.

Prince Edward Island

Information on archaeological and historical resources in PEI was not made available for this document.



License Areas
- Corridor EL 2368
- Amoco SDL-082

Transportation
- Roads
- Rail
- Ferry

Contours
- 305 Meters
- 152 Meters
- 50m
- 100m
- 150m

0 50 100

Kilometres

Environmental Studies Research Fund
Southern Gulf of St. Lawrence Mapping Project

Jacques Whitford Environment Limited

Significant Coastal Archaeological Sites

Data Source: Independent Research NS & NB Provincial Museums

Map Projection: Geographic (Lat./Long.)
Horizontal Datum: NAD83
Map Scale: 1 : 850 000

Data Gaps and Data Quality

Data Gaps

Several data gaps representing ecologically and commercially important areas are evident in the maps and accompanying text. There is a poor understanding of the nursery and retention areas for larval and juvenile stages of most marine fish species. The majority of DFO's Gulf of St. Lawrence fisheries surveys are conducted in the fall, thus the early life stages of many species are not routinely monitored and older data should be consulted.

No systematic mapping of the aboriginal use of marine and coastal resources has been completed in the study area. However, several projects that involve delineation of traditional ecological knowledge (TEK) are in the planning stage. The most recent TEK mapping project was completed for Maritimes & Northeast Pipeline Project.

Mapping of marine habitats within the study area is limited. Therrien et al. 2000 compiled and mapped existing information on resources in eastern NB for DFO. Much of the information in that report is included in this atlas.

Information on cetacean distribution is anecdotal, limited and dated. There is no program that monitors and records the presence of whales and dolphins in the Gulf of St. Lawrence.

Archaeological and historical records are not maintained by Prince Edward Island provincial authorities, therefore data is difficult to obtain.

Data Quality

The objective of this project is to deal systematically with published resource information on the southern Gulf of St. Lawrence and to provide a base upon which further study can begin. This atlas has not been prepared for those who study cartography, but rather for those who intent to extend their knowledge of the resources as it relates to the content of this project. Because maps are primarily concerned with location, even detailed, scaled, and systematic representation of all or part of any subject in the southern Gulf of St. Lawrence will inevitably provide only a partial understanding of the subject. The maps provided must be thoroughly examined by the user. There are sources of error that may affect the quality of a GIS dataset; some are quite obvious, but others can be difficult to discern. Few if any of these errors can be automatically identified by the GIS itself. Particular care should be devoted to checking for errors because GI Systems are capable of lulling the user into a false sense of accuracy and precision unwarranted by the original data.

Obvious Sources of Error:

Age of data
Data sources may be too old to be useful or relevant to current understanding of the resource or subject.

Coverage
Data on a given area may be lacking, or only partial levels of information may be available.

Map Scale
The ability to show detail in a map is determined by its scale. The general scale of the atlas 1:850 000 is suitable for the entire southern Gulf of St. Lawrence, however, care should be taken not to interpret the maps beyond the scale provided.

Interpolation
Often the desired data regarding a site or area may not exist and substitute data may have been used instead. A valid relationship must exist between the substitute and the subject it is used to study but, even then, error may occur because the subject is not measured directly. For example, discontinuous distributions of organisms and environmental conditions are characteristic traits of aquatic environments. Yet biological and physical measurements are often averaged or interpolated over large areas of distances as can be seen in the snow crab modeling.

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whale: www.gnb.ca/cnb
birds: www.webshots.com

Glossary

alga
Any of various chiefly aquatic, eukaryotic, photosynthetic organisms, ranging in size from single-celled forms to the giant kelp.

amphipod
A small crustacean of the order Amphipoda, such as the beach flea, having a laterally compressed body with no carapace.

anadromous
Migrating up rivers from the sea to breed in fresh water.

aquaculture
The science, art, and business of cultivating marine or freshwater food fish or shellfish, such as oysters, clams, salmon, and trout, under controlled conditions.

benthos
Bottom-dwelling organisms including plants, invertebrates, and vertebrate animals that inhabit the bentic zone of a water body.

biomass
The total mass of living matter within a given unit of environmental area.

bivalve
A mollusk, such as an oyster or a clam, that has a shell consisting of two hinged valves.

copepod
Any of numerous minute marine and freshwater crustaceans of the subclass Copepoda, having an elongated body and a forked tail.

crustacean
Any of various predominantly aquatic arthropods of the class Crustacea, including lobsters, crabs, shrimps, and barnacles, characteristically having a segmented body, a chitinous exoskeleton, and paired, jointed limbs.

demersal
Dwelling at or near the bottom of a body of water: *a demersal fish.*

dichotomous
Divided or dividing into two parts or classifications.

flatfish
Any of numerous chiefly marine fishes of the order Pleuronectiformes, including the flounders, soles, and halibuts, having a laterally compressed body with both eyes on the upper side.

frond
A leaflike thallus, as of a seaweed or lichen.

gadoid
Of or belonging to the fish family Gadidae, which includes the cods and the hakes.

holdfast
An organ or structure of attachment, especially the basal, root-like formation by which certain seaweeds or other algae are attached to a substrate.

intertidal zone
Zone between high and low tides.

invertebrate
Lacking a backbone or spinal column; not vertebrate.

kelp
Any of various brown, often very large seaweeds of the order Laminariales.

larvae
The newly hatched, earliest stage of any of various animals that undergo metamorphosis, differing markedly in form and appearance from the adult.

marsh
An area of soft, wet, low-lying land, characterized by grassy vegetation and often forming a transition zone between water and land.

metamorphosis
A change in the form and often habits of an animal during normal development after the embryonic stage. Metamorphosis includes, in insects, the transformation of a maggot into an adult fly and a caterpillar into a butterfly and, in amphibians, the changing of a tadpole into a frog.

migrate
To change location periodically, especially by moving seasonally from one region to another.

mollusk also **mollusc**
Any of numerous chiefly marine invertebrates of the phylum Mollusca, typically having a soft unsegmented body, a mantle, and a protective calcareous shell and including the edible shellfish and the snails.

molt
To shed periodically part or all of a coat or an outer covering, such as feathers, cuticle, or skin, which is then replaced by a new growth.

pelagic
Of, relating to, or living in open oceans or seas rather than waters adjacent to land or inland waters: *pelagic birds.*

phytoplankton
Minute, free-floating aquatic plants.

plankton
The collection of small or microscopic organisms, including algae and protozoans, that float or drift in great numbers in fresh or salt water, especially at or near the surface, and serve as food for fish and other larger organisms.

pleopod
One of the paired abdominal appendages of certain aquatic crustaceans, such as shrimp, lobsters, and isopods, that function primarily for carrying the eggs in females and are usually adapted for swimming. Also called swimmeret.

polychete also **polychaete**
Any of various annelid worms of the class Polychaeta, including mostly marine worms such as the lugworm, and characterized by fleshy paired appendages tipped with bristles on each body segment.

predaceous
Living by seizing or taking prey; predatory.

protected area
Area administratively set aside as a buffered or structured area that is shielded from damage from anthropogenic disturbances.

pteropod
Any of various small marine gastropod mollusks of the subclass Opisthobranchia that have winglike lobes on the feet.

seine
A large fishing net made to hang vertically in the water by weights at the lower edge and floats at the top.

voracious
Consuming or eager to consume great amounts of food; ravenous.

wetland
A lowland area, that is wet at least for part of the year, such as a marsh or swamp.